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The Small Arms Board of the U. S. Navy has unanimously recommended for adoption in the navy and marine corps the Lee rifle, the invention of Mr. J. P. Lee, of Connecticut. The new rifle weighs 8¼ lbs., with the straps; the barrel is only 27 ins. long and is made of nickel steel, and the caliber is so small that the sailor can carry 200 rounds. It is lighter than the Krag-Jorgensen rifle, has a flatter trajectory and a rapidity of fire exceeding that of any other small arm, as five shots have been aimed and fired in three seconds when the gun was under test. At 500 yds. range perfect fire can be had; at 2,000 yds. range the accuracy is sufficient to hit an object the size of a man, and at 6,000 yds. range the bullet would still have force enough to penetrate the body of a man.

A substitute for cocoa cellulose, for use on warships to close up shot holes, has been invented by Mr. M. Marsden, of Philadelphia. It is made from the pith of Indian cornstalks by a special process. Tests have been made by Naval Constructor Linnard, by firing with a 6-in. gun at a box filled with this new material. In one place a single shot was fired through it, and at another place five shots were grouped in a circle of 8 ins. diameter. Under a head of water of from 4 to 7 ft., no water passed through 3 ft. of this material in three hours. An examination showed that the water had penetrated 11 ins. in the case of the single shot, and 12 ins. in the group of shots. The material is absolutely incombustible and has about one-third the density of the best foreign cellulose.

Twelve-inch guns are large enough for our new battleships, says Chief Constructor Hichborn, in a supplemental report to the Secretary of the Navy, in combatting the recommendation of 13-in. guns by the Chief of Ordnance. Mr. Hichborn reviews the best and latest foreign practice in this direction, and finds that 12-in. guns are the largest now being put aboard ships of war. He denies the broad claims made for the much greater efficiency of the larger gun under the conditions of actual battle, and believes that recent events prove that much attention should be paid to powerful secondary batteries. Mr. Hichborn says he is guided in his recommendation by general considerations of the best possible distribution of armor, armament, engine power, endurance, etc., to the end of producing the best fighting machine possible. The mechanical difficulties which were encountered by the English and French in handling the older heavy guns on board ship do not influence him.

The 18-in. Carnegie armor-plate, which successfully resisted shots from a 12-in. and a 13-in. gun, on May 1, was shattered, on May 17, at Indian Head, by a harder blow from the 18-in. gun. In the last trial an 1,100-lb. Wheeler-Sterling solid steel shot was used, with a muzzle velocity of 1,942 ft. per second, and a striking energy of 28,800 ft.-tons. This shot broke the right half of the plate into four pieces, completely demolished the oak backing and passed into the sand-bank beyond. But the shot was found broken to pieces, with the head whole, but the point slightly fused. The ordnance officers decided that no armor in existence could have kept out this shot at 1,300 yds. range. The experts claimed, however, that the test was not conclusive against the armor, as this plate had already stood the strain of two acceptance shots from the heaviest guns. A second steel shot, similar to the last, but hollowed out to receive 53 lbs. of explosive, struck the plate where it was only 15.6 ins. thick. This shot had the same velocity and also broke the plate after the shell had penetrated 7 ins. and passed through; but the shot was found in fragments.

The steel harbor-defense ram "Katahdin," built at the Bath Iron Works, Bath, Me., has failed, on a preliminary trial, to develop the speed required in the contract of 1891. This contract called for 17 knots on a maximum I. HP. of 4,800. On the contractor's trial, of May 15, the "Katahdin" is said to have developed only 16¼ knots with 5,500 I. HP. The trouble is said to be due to the design of hull, which tends to cause the bow to dip at very high speed, scooping up and carrying many tons of dead weight in water. The same tendency was noted as long ago as 1864 in the side-wheel rams "Vindicator" and "Avenger," built for the Mississippi River squadron during the Civil War. The lenticular cross-section of the hull favored the piling of water on the upper side of the wedge when a high rate of speed was developed. This experience should have been a warning to the designers of the "Katahdin."

The most serious railway accident of the week was a derailment, May 17, near Hornellsville, N. Y., on the New York, Lake Erie & Western R. R. A broken wheel on a car of a fast freight train caused the ditching of ten cars, and three men were killed.——A broken rail near Silex, Mo., caused the derailment of a passenger train on the St. Louis & Hannibal R. R., May 14, in which one man was killed and 17 were injured, some seriously.——The wreckage resulting from a collision between the two sections of a parted westbound coal train on the Philadelphia & Reading R. R. blocked the eastbound track near Bound Brook, N. J., May 18, and was run into by an eastbound fast freight train, the engineman of this latter train being killed.

The machinery of the Van Buren St. rolling lift bridge at Chicago broke down May 14, and the bridge could not be closed, so that street traffic has to be diverted to other bridges. It is said that it will take a week or two to make repairs. The bridge was illustrated and described in our issue of Feb. 21.

An explosion of 8,000 lbs. of nitro-glycerine and 2,000 lbs. of Hercules powder occurred May 21 at the California Powder Works, at Pinole, Cal., and five men were killed. The damage and loss will amount to about $250,000.

While a new roof was being erected at the South Norwalk station of the New York, New Haven & Hartford R. R., on May 20, the scaffolding was struck by the cab of a locomotive, and the roof fell to the ground. Three or four men were slightly hurt.

The Bridge St. draw over the Passaic River at Newark, N. J., was locked May 12 by the expansion of the rails of the electric railway under the hot sun. A tug and schooner ran into the bridge while thus closed, doing some damage.

A rear collision of electric cars occurred May 19 at Bensonhurst, Long Island, on a suburban line of the Brooklyn City R. R. Both were crowded, and a number of persons were injured, two or three being seriously hurt. Failure of the brakes is given as the cause of the accident.

The Newport & Cincinnati bridge over the Ohio River at Cincinnati, O., is to be renewed, the work being done by the Pennsylvania Lines west of Pittsburg. Mr. M. J. Becker, M. Am. Soc. C. E., Chief Engineer, writes us that the present structure was built in 1871, and is no longer sufficient for modern requirements. It is, therefore, proposed to remove the existing superstructure, and replace it by a new one of steel, with sufficient capacity to carry, in addition to the regular railway traffic, a double line of rapid transit electric street cars, a carriageway for ordinary highway traffic and a footwalk. This will require the lengthening of the piers to accommodate the enlarged superstructure. In connection with the general reconstruction, it is proposed to increased the channel span from 400 ft. to 500 ft. clear span, and to adjust the adjacent spans so as to admit of this change. The approach on the Cincinnati side will be lengthened out, so as to reach further into the city, and at the same time reduce the grade. The approach on the Newport side will also be extended southwardly, in order to cross a street car track overhead, which now crosses the railway track at grade. The estimated cost of this work is about $700,000. The substructure work, embracing the masonry and foundations, has been awarded to Jutte & Foley, of Pittsburg, and the superstructure work has been given to the Edge Moor Bridge Works, of Wilmington, Del.

The old wooden bridge crossing the Delaware River at Easton, Pa., is to be replaced by a modern structure. The Easton "Free Press" says this bridge was commenced in 1797, and the abutments and the pier foundations were in place in 1798. The "Fries Rebellion" against the collection of direct taxes delayed the work until May, 1800, when a bridge lottery was authorized by the state for its completion; but it was not until May, 1805, and until after several other lotteries had been drawn on account of the bridge, that work was resumed. The bridge was opened to the public on Oct. 14, 1806, after the state legislature had loaned the bridge company $10,000 to pay for covering the bridge. Its length, exclusive of abutments and wing walls, was 570 ft.; it had three spans of 155, 157½ and 159 ft., respectively, measured on the chord of the arches. The bridge was 29 ft. wide, with two carriageways, each 12½ ft. wide in the clear. The piers were 31½ and 36½ ft. wide at the tops, 40 ft. long and 27 ft. high above low water-mark. The deepest water in the river was 18 ft., at the western pier. The foundations were wooden cribs filled with stone.

A new highway bridge is being built at the Falls of Schuylkill, in Philadelphia, to replace a wooden structure carried away by a flood three years ago. The new bridge is built of steel, is of the Pratt type, and has three spans of 180 ft. each, with a 26-ft. roadway and two 7-ft. sidewalks. The floor system is very heavy, each span weighing 835 tons, and the floor will be laid with asphalt. The contractors for the whole work are Filbert & Porter, and the Edge Moor Iron Co. has built and erected the bridge, driving the last pin on April 11 last. Work was commenced in September, 1894. The cost is not given in the Philadelphia "Record," from which this item is taken, but the bridge is said to be the heaviest steel bridge in that city, either for railway or highway purposes. From the plans shown, it can hardly be called a fitting structure in appearance to connect two sections of Fairmount Park. It is a rectangular railway truss seemingly without any attempt at ornamentation. It doubtless is strong enough; but it is not such a bridge as a city should build within its limits for highway purposes.

The water-supply facilities of Philadelphia are being largely increased. The Queen Lane reservoir, commenced in 1892, and nominally finished in 1894, has a capacity of 350,000,000 gallons, and the Roxborough reservoir, completed in 1893, has a capacity of 150,000,000 gallons. Both of these reservoirs leak badly and bad work is charged. To supply the first-named reservoir, four pumps of 20,000,000 gallons each are being erected on the Schuylkill, near the mouth of Wissahickon Creek; they are being built by the Southwark Foundry & Machine Co. Two 3,000,000-gallon Worthington pumps, brought from the Fairmount station, are being set in as a high-service supply on George's Hill; and a 5,000,000-gallon Worthington pump is being erected at Roxborough for the high service there. At the Spring Garden pumping station, two new Holly pumps, of 30,000,000 gallons each, are being built to pump into the East Park reservoir, with a lift of 133 ft. The combined pumping capacity of this station will be 210,000,000 gallons daily when these pumps are completed. At the Frankford pumping station a new 15,000,000-gallon vertical compound pump is being erected to pump into the Wentz Farm reservoir.

Construction has been started on the works of the Pioneer Electric Power Co., at Ogden, Utah. The work, as then proposed, was described in Engineering News for Nov. 8, 1894. The original plans will be followed, with the exception that the dam will not be built now. The natural flow of the Ogden River will be used for the present, and 125 cu. ft. per sec. is calculated on as its minimum supply, which will develop 5,000 HP., net. The contract for the pipe line complete has been let to Rhodes Bros., of Denver, for prices aggregating about $400,000. About 25,000 ft. of wooden stave and 6,000 ft. of steel conduit will be built, all 6 ft. in diameter. The contractors promise to have the water at the mouth of the canyon ready for use in the power house by Nov. 1, 1895, and the company expects to complete the power house by that time. This will be equipped with sufficient machinery to develop 6,500 HP., gross, or 5,000 net. The dam for the storage reservoir will be built in due time, when the additional power can be sold. The laborers are to be employed from among Ogden men, in accordance with a promise made by the company at its inception. We are indebted to Mr. W. P. Hardesty, of Salt Lake City, for the above information.

THE NEW WATER SUPPLY OF ATLANTA,

By Joel Mable.*

The following description and the accompanying illustrations of the new water supply works for Atlanta may be of especial interest to the readers of Engineering News just now, in view of the fact that the American Water-Works Association will meet in that city next week.

The Union depot represented on the map, Fig. 1, is the center of the city, the line marking the city boundary being a circle with a radius of 1¾ miles. The distance from the center of the city to the Chattahoochee pumping station is 6½ miles, the reservoir being 3½ miles from the latter. The dotted lines along Chattahoochee Ave. represent the 30-in. main from the river pumping station to the reservoir.

The 48-in. intake pipe, Fig. 3, is 650 ft. in length, having a perforated cross on the end in the river. A masonry crib is built around the submerged end and covered over with iron rails. A circular dike 1,000 ft. in length, 12 ft. crown, with 2 to 1 slope on outside, and ½ to 1 on inside, and 18 ft. high, is built all around the power house as a protection against high water.

The excavation for the reservoir, shown in plan in Fig. 1, and in cross-section through the embankment at G H in Fig. 4, amounted to 290,000 cu. yds. Most of the material was used in constructing the embankments. The puddle walls were made of selected gritty clay, taken from inside the reservoir and deposited in layers of 6 ins., properly moistened, mixed with revolving disk harrows, and then thoroughly rolled or tamped. The embankments and puddled walls were built up at the same time, the material on each side of the puddle being deposited in layers not exceeding 12 ins., and rolled down with grooved iron rollers weighing 4,500 lbs. Care was taken to put the best material on the water side. All soil was removed from the base of the embankments to a firm foundation, and the puddle ditches were excavated below this, in some places to solid rock, and in every instance to an impervious stratum. The highest part of the embankment is 82 ft. from base to crest. About in the center of this highest part a spring was found. It was carefully boxed up with cemented stone masonry and the water was conveyed in a 4-in. pipe to a point below the dam. A driveway 40 ft. in width and 4,154 ft. long encirles the reservoir. The roadway is given a slope, away from the reservoir, the inside being 6 ins. higher than the outside.

The area of the water surface in the reservoir is 908,074 sq. ft., or a little over 20 acres, and the available capacity is 177,200,000 gallons. The inner slope is paved with stones 9 ins. in thickness to a point 2 ft. in elevation above the surface of the water, and the margin between that point and the top is set with grass.

The overflow and outlet towers are built of brick, laid in cement and pitched on the outside. The overflow is circular, has an inside diameter of 3 ft. and walls 2½ ft. thick; the outlet tower is octagonal, has walls 2½ ft. thick, an inside diameter of 2½ ft., and a slide gate 2 ft. square in each face. The lowest of these gates is 3 ft. above the top of the outlet pipe, and the remaining ones are arranged spirally at elevations about 3 ft. apart, thus allowing water to be admitted at different heights.

The machinery consists of four Gaskill horizontal compound condensing engines, two at the Chattahoochee station and two at the reservoir station, each guaranteed to lift 2,000,000 gallons in 24 hours, against a head of 105 lbs. for domestic pressure, and 160 lbs. for fire service, with a piston speed not to exceed 120 ft. per minute. The stipulated test duty, on a run of 24 hours, was 105,000,000 ft.-lbs., when pumping at the rated capacity against a head of 105 lbs., and was to be based upon an evaporation by the boilers of 10 lbs. of water to 1 lb. of coal, from and at the temperature of the feed water, with a steam pressure of 80 lbs. per sq. in. at the throttle valve when running. The formal test was entirely satisfactory, being somewhat in excess of the guaranteed duty.

At the reservoir station, Fig. 5, there are two batteries of three boilers each, and at the river station, three batteries of three boilers each. The boilers are of the return tubular type, 5 ft. in diameter and 16 ft. in length.

The filtering plant, Fig. 5, consists of eight filters 8 ft. in diameter and 18 ft. in length, each having a filtering capacity of 500,000 gallons per day. They were furnished and erected by the New York Filter Co.

A 30-in. main passes around the west side of the reservoir and connects with the 36-in. outlet main.

Judge George Hillyer is President of the Water Board; Mr. W. G. Richards is Superintendent of the Water-Works, and Mr. R. M. Clayton is City Engineer.

* Senior partner in the firm of Mable & Sullivan, Engineers-in-Charge of Construction.

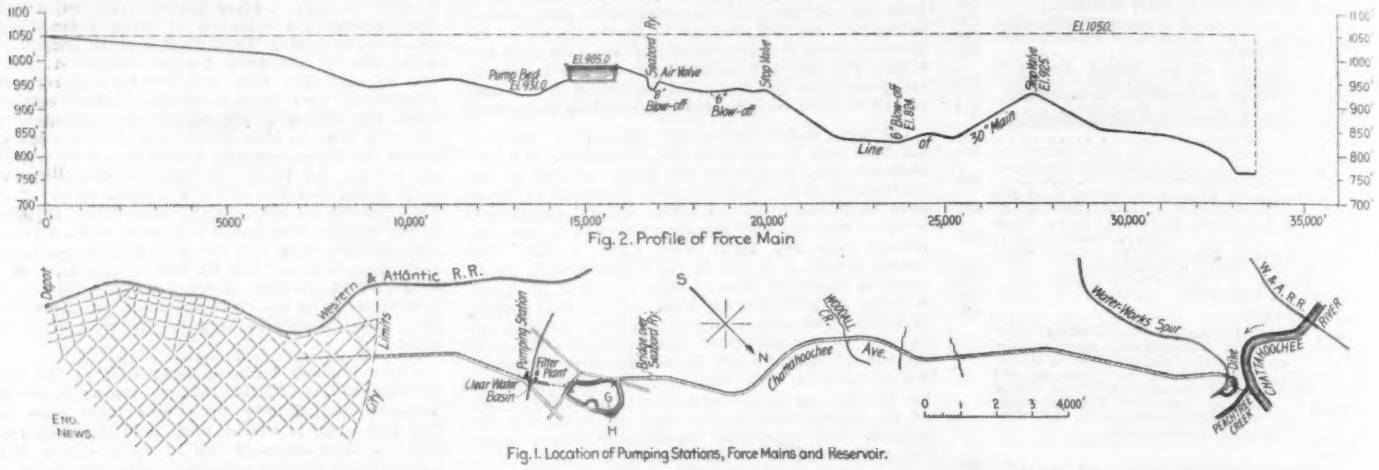


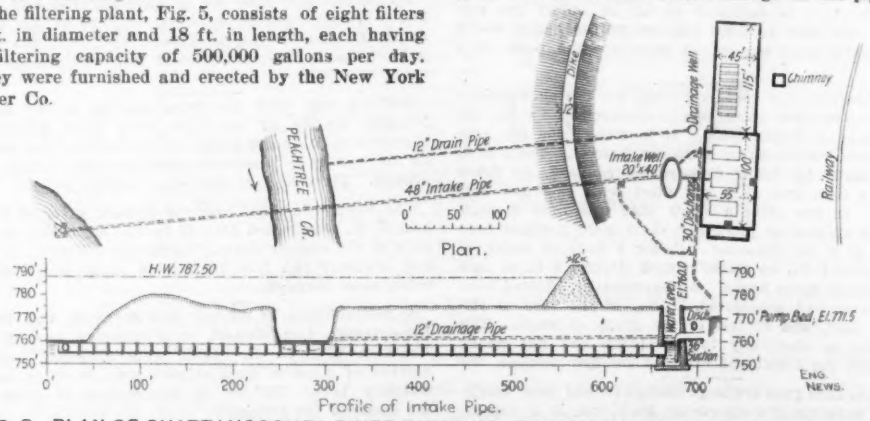
Fig. 2. Profile of Force Main

Fig. 1. Location of Pumping Stations, Force Mains and Reservoir.

FIGS. 1 AND 2. GENERAL PLAN OF NEW WATER WORKS OF ATLANTA, GA., AND PROFILE OF FORCE MAIN.

In the operation of the boom, one arm carried the traveling carriage, with which the load was hoisted and held in place, and from the other arm was suspended a corresponding counter-weight attached to a line. The hoisting line, after it left the traveling carriage, passed down the center of the scaffold into the masonry archway, or valve vault, under the tower, and thence to the drum of the hoisting engine located in a temporary building just at the right of the stand-pipe.

The contractors believe that this style of scaffolding is original with them, and that it is much preferable to scaffolding built on the outside, as is the common practice in the erection of stand-pipes. When this mode of scaffolding is made use of, and is carried up to a considerable height, its stability to resist wind strains before enough of the pipe is



Profile of Intake Pipe.

FIG 3. PLAN OF CHATTAHOOCHEE RIVER PUMPING STATION AND PROFILE OF INTAKE PIPE.

NEW STAND-PIPE AT ST. BERNARD, O.

By George Hornung, M. Am. Soc. C. E.

Stand-pipe construction has lately been given some attention in engineering journals. The writer believes he can add somewhat thereto in the following description of the water tower recently completed for the water-works of St. Bernard, O., of which he is the engineer. The acompanying view illustrates the method of scaffolding adopted by the contractors in this case. The scaffold as shown was erected on the inside of the pipe after the lower five-ring courses were in place and riveted up.

and may not at all times be sufficiently appreciated and provided for in scaffold work because of its temporary purpose.

In this case, the first scaffolding put up was blown down by a severe windstorm, which occurred unexpectedly to the contractors on the night of Jan. 26, 1895. When the accident occurred the tenth ring course, or 50 ft., of the pipe was in place, and the scaffold extended 60 ft. above that.

Fortunately for the contractors, the wreck was blown in a direction where there were no buildings. The pipe, as may be expected, was not injured in the least, yet the daily papers, for the want of proper information, reported that the stand-pipe was blown down by the wind and completely wrecked, and that it would be weeks before the damage done to it could be made good, when as a matter of fact the contractors within five or six days had reconstructed the blown-down scaffold

and were again at work on the erection of the pipe.

The pipe is 20 ft. in diameter and its height above the foundation is 115 ft. The height of the foundation above the natural surface of the site is 11 ft., which gives a total height for the tower of 126 ft.

The masonry and the metal part of the tower were contracted for separately. The latter was awarded to the L. Schreiber & Sons Co., of Cincinnati, on July 14, 1894, and they commenced erecting the following November. The competitive bids for this work were as follows:

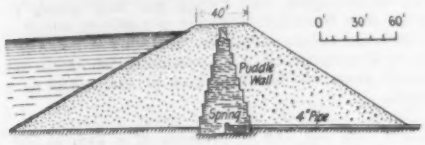


Fig. 4. Cross-Section of Reservoir Embankment on Line G H.

The L. Schreiber & Sons Co., Cincinnati, O.	$6,189
The Brownell Co., Dayton, O.	6,546
Mansfield Machine Works, Mansfield, O.	6,571
The Cincinnati Architectural Iron Works, Cinn.	6,800
R. Munroe & Son, Pittsburg, Pa.	7,294
Stacey Manufacturing Co., Cincinnati, O.	7,300
Riter & Conley, Pittsburg, Pa.	7,500
The Enterprise Boiler Co., Youngstown, O.	7,940

The following are extracts taken from the specifications prepared by the writer for this work:

The metal to be of homogeneous steel plate, and must, to be acceptable, possess the following qualities:

Minimum and maximum ultimate tensile strength per square inch of sectional area, 55,000 and 63,000 lbs., respectively. Elongation in 8 ins., not less than 25%. Reduction of area at fracture, not less than 50%. Maximum amount of phosphorus, 0.06%.

Each plate must be smooth, and its specified thickness must be uniform, and must have the name or brand of the maker, with its guaranteed tensile strength legibly stamped upon it. In addition to this the contractor will be required at his expense to have all the plates properly tested at the mills where they are manufactured by a person of known and recognized ability for performing such services, who will be required to stamp with his private mark or monogram all the material accepted by him, and the contractor must furnish the Trustees' Consulting Engineer a certified report, made by the Inspector, giving the results obtained of the tests, as to the metal's ultimate tensile strength, elongation, reduction of area and phosphorus contained, and if the material does not possess all the qualities called for it will be rejected.

The shell of the tower is to be made up of 23 ring courses. Each ring to contain five plates in circumference, and to be of a width, to have the lines of rivets in the horizontal joints to measure 5 ft. between centers.

The plates composing the rings or courses of the shell to be of the following thicknesses from the bottom upwards:

No. of course...	1,2	3	4-8	9	10,11	12	13,14	15	16,17	18-23
Thickness, ins..	13/16	3/4	11/16	5/8	9/16	1/2	7/16	3/8	5/16	1/4

The vertical joints of the six lower rings to be triple staggered riveted, and the remaining vertical joints to be double staggered riveted. Horizontal joints to be single riveted throughout.

The rings must have parallel sides, and they must be placed alternately in and out in building up the pipe, starting with the lower ring as an outer one.

The diameter and spacing of the rivets, and the size of the laps of the different joints, to be correctly proportioned, so that the shear strength of the rivets will be equal to the strength of the plates along the lines where they are riveted.

Rivet holes for the joints of plates 7-16 in. and less in thickness may be punched and smoothly reamed, and the rivet holes in plates of greater thickness than 7-16 in. must be drilled. When punch is used it must be done without injury to the metal.

All the rivets to be of "Burden's best," and the driving and heading of same must be equal to the requirements exacted by the best practice when doing this class or character of work.

The punching and drilling of the plates must be done with a sufficient degree of accuracy to have the holes come fair, to properly admit the rivets through the plates when in place to be jointed, as the use of the drift pin to strain and draw the plates to have the work come together will not be tolerated at any time.

All the seams to be calked water-tight on the outside and inside of the shell of the pipe with proper calking tools. The calking edges of the plates to be planed or chipped bevel before they are erected in the pipe.

It will be seen, that from the specified strength and thickness of the plates, and the joint riveting, this pipe has a factor of safety a fraction greater than 5 at the joints and about 7 in the body of the plates. The tower is situated in the best part of the town, and closely surrounded by dwellings, therefore the above factors of safety, which are considerably higher than is usually the case in standpipe work, were adopted for the purpose of relieving the fears property owners in the immediate vicinity might have as to the safety of the tower when filled with water.

The contractors placed the order for the material with the Carnegie Steel Co., of Pittsburg. It was all tested as stipulated in the specifications, and reported to the writer in detail, and the correctness thereof was finally verified to under oath by the engineer who conducted the tests. The following are the results of the tests (and in the last column are given the contract requirements.—Ed.):

Minimum tensile strength, lbs.	55,180	55,100
Maximum " " "	64,200	63,000
Average " " "	59,455	.....
" elastic limit, lbs.	36,594	.....
" elongation, %	31	25
" reduction of area, %	57	50
" phosphorus, %	0.2	0.06
Appearance of fracture	Silky	angular

From the above reported tests it will be seen that the objectionable and much-dreaded element of phosphorus is considerably less than the limit given in the specifications, hence the metal in that respect is proportionally superior than contracted for.

That this material is exceedingly ductile and tough was shown from its behavior during the process of drilling and planing the plates. The writer has in his possession a number of drill cuttings of this metal 3 ft. long.

The riveting in the body or shell of the tower was done altogether with a pneumatic riveting machine. The machine and the operator's platform are shown in the view as they are suspended and swung into position by the boom.

Notwithstanding that the contractors always manifestly aimed to do their work in the best possible manner, it was from start to finish under the eyes of a competent inspector, and under the general supervision of the writer. The tower was completed and filled with water the first time on March 27, 1895.

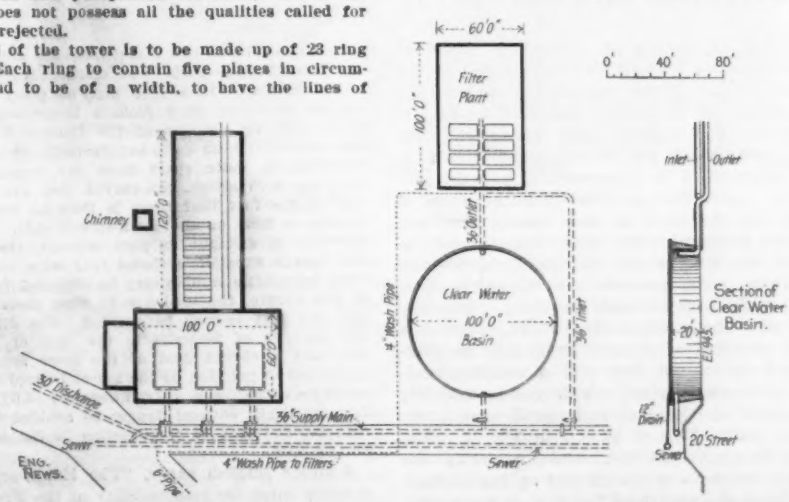


FIG. 5. PLAN OF RESERVOIR PUMPING STATION, FILTER PLANT AND CLEAR WATER BASIN.

Stand-Pipe Under Construction from Inside Scaffolding, St. Bernard, O.

A trolley line to the Pyramids seems as incongruous as the railway to Jerusalem; but U. S. Consul-General Penfield, of Cairo, says that the electric line is soon to be built. Mr. Penfield further says that, in proportion to population, Egypt now has a greater mileage and better railway service than Austria-Hungary, Spain or Portugal. It is all government property.

SWISS FORESTRY OBSERVATIONS.

In the reports of the Swiss Forestry Commission there is a series of meteorological observations, made in the Canton of Berne, that are of much interest to those engaged in forest culture. These observations cover quite an extended period, commencing on Jan. 1, 1869, and continuing without interruption to December, 1887. The general results of these observations are thus set forth:

The monthly and yearly average temperature in the forests, excepting winter months, is below the temperature on open land, measured at a height of 3 m. above the soil, with a greater difference at 4 p. m. than at 9 a. m. This difference increases with the greater annual heat, and reaches its maximum in July. In winter there is little variation between the forest temperature and that of the open land, but the former is usually slightly higher. In pine and larch forests the air is cooler than in beech forests.

From October to March the temperature of the soil increases with the depth, and decreases from April to September. The temperature of the soil decreases to a depth of from 2 to 3 ft., and then begins to rise, and the daily oscillations of temperature are not felt below about 1 ft. In the forests the surface of the soil is always cooler than the air.

Of late years experimental rain-gages have been

set in the forests with the purpose of ascertaining how much of the rainfall is retained by the tree-tops. In a thick pine forest, 40 to 80 years old, only about 55 to 60% of the precipitation, measured in the open field, fell to the soil. While as a rule the age of the forest has no apparent influence, the age of beech trees makes a considerable difference in the volume falling to the ground. In a beech forest 20 years old almost the total precipitation reached the soil, while in a beech forest from 50 to 90 years old, 75 to 80% only fell to the ground. As a yearly average, the crowns of pine trees retain from 40 to 45% of the rainfall on the open soil, and beech trees retain from 20 to 25%.

Dr. Henne reports upon the temperature of the upper strata of different kinds of soil, giving the nature of the soil and its color. In the table presented, local names are given to these soils; but, for the seven months from April to October, the highest temperature, 62.3° F., is given to red, black and grayish white soils, the average temperature of the air being 57.7° F. The average temperature of gneiss soil was 61.2°; of Jura chalk, 60.6°; gray sandstone, 60.3°; dark-gray clay and gray limestone, 59.9°. The average difference in temperature for the seven months was 1.4°, and while on sunny days the difference rose at 1 p. m. to 8.3°, it fell on dark days sometimes below 1°. On damp soils the influence of color in the soil amounted to nothing.

FAILURE OF THE DAM OF THE BOUZEY RESERVOIR, FRANCE.

The construction of the masonry dam of the Bouzey reservoir, near Epinal, France, and the manner of its failure on April 27, were described in our issue of May 9, and we publish this week some further particulars, with sections showing the original design and the reinforcing work carried out after a partial failure of the dam a few years ago. Fig. 1 shows the section given by Mr. Edward Wegmann, Jr., M. Am. Soc. C. E., in his work on "The Design and Construction of Masonry Dams," published in 1888. His description of the dam is given below, and it will be noted that the guard wall referred to as being constructed under the upper face of the dam to prevent leakage at the foundations, was apparently of but little use, as a number of springs developed in front of the dam as soon as the reservoir was filled. The absolute necessity of a good foundation for a dam has been constantly urged and has been proved by numerous accidents due to faulty foundations. But the lessons of experience appear to have been overlooked in this case (and, according to report, in other French dams), the dam itself not being carried down to the solid rock, though no good reason is to be seen why this should not have been done, since the solid rock was (according to the descriptions) reached by the guard wall. Mr. Dawson, in the paper quoted in our issue of May 9, stated that it was not necessary that the whole thickness of the dam should rest upon the impermeable beds, a conclusion which appears to have been disproved. Mr. Wegmann's description is given below; but it will be noted that he says the wall was built "a little distance above the dam," and does not show it on his section, whereas the section, Fig. 2, and the other descriptions, locate the guard wall directly under the up-stream face of the dam, simply making the face deeper than the body of the dam. This latter is probably the correct description:

The Bouzey dam was constructed to form a reservoir of 7,000,000 cu. m. (1,848,987,000 gallons) capacity, situated about 4½ miles from the town of Epinal (Vosges). The general dimensions of the dam are:

	Meters.	Ft.
Length on top	471	1,545.30
Height above river bed	15	49.21
" " foundation	23	75.46
Width at top	4	13.12
" " base	12	39.37

The plan of the wall is straight. The profile was designed to be one of "equal resistance," each joint being assumed perpendicular to the resultant of all the forces acting on it. When the reservoir is full, there is some tension in the masonry near the back face. The dam was founded on a porous conglomerate rock consisting of silicious stones joined together with a rather weak cementing material. Specimens of this rock resisted a crushing load of 300 to 600 kilos per sq. cm. (307 to 614 tons of 2,000 lbs. per sq. ft.), but broke under a tensile strain of only 11 kilos per sq. cm. (157 lbs. per sq. in.).

The trench for the foundation was excavated to comparatively good material, but did not reach the absolutely solid rock. To prevent, however, any leakage from the reservoir, a wall 2 m. (6.56 ft.) thick was built a little distance above the dam from the solid rock to the river bed.

In 1882 the reservoir was filled. When the water had reached an elevation 3.32 m. (10.89 ft.) below the top of the wall, a number of springs appeared in front of the dam. Two of them shot upward about 5 ft. high, like geysers, discharging a large amount of water. Their flow soon decreased, however, and remained constant at the rate of about 300 liters (79 gallons) per second. At the same time about 135 m. (442.93 ft.) of the wall moved down stream, so as to form an arc, concave towards the reservoir, having a versed-sine of 0.37 m. (1.22 ft.). This movement has been attributed by some engineers to the tension at the back face. Many vertical fissures appeared also at the front face. For some time the engineer in charge of the work kept the water in the reservoir at a low level. The fissures in the wall opened in winter and closed in summer, each discharging on an average 1 liter (0.26 gallon) per second. In 1885 the water was finally allowed to reach its maximum elevation, 0.6 m. (1.97 ft.) below the level of the wall, without any new trouble being experienced.

In a paper presented at the International Congress on Inland Navigation, held in Paris in 1892, Mr. Denys stated in regard to this initial failure that the whole mass moved bodily down stream, changing the plan from a straight line to a curve,

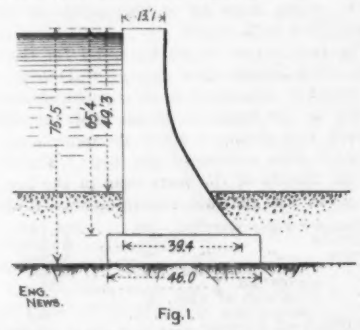


Fig. 1.

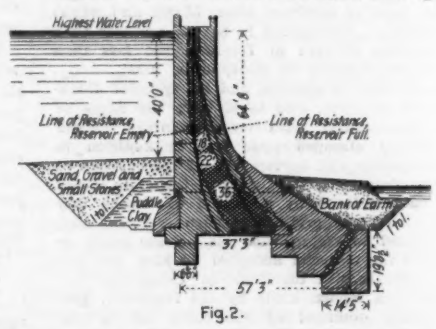


Fig. 2.

Fig. 1. Original Section of the Bouzey Dam (not showing the Guard Wall under the Upstream Face).

Fig. 2. Reinforced Section of the Bouzey Dam.

there being no sinking or tilting of the dam. This deformation caused cracks at the middle and both ends of the curve, the leakage from which amounted to nearly 8,000,000 gallons in 24 hours. The guard wall under the up-stream face, which had been carried down to ground supposed to be impermeable, had not prevented the water from penetrating into fissures of the rock, and the water in these fissures developed an upward pressure, which practically reduced the weight of the dam, so that the horizontal pressure of the water in the reservoir was enabled to force the body of the dam outward, detaching it from the guard wall. The strengthening works, undertaken in 1889, consisted of a masonry footing or abutment wall below the dam and a concrete backing of triangular section which was toothed into the masonry of the dam and rested against the abutment wall. This is shown in Fig. 2. The concrete backing, however, while rendering the foundation secure, was not carried up high enough to strengthen the section of the dam to resist horizontal pressure. Parts of the foundation which had been dislocated by the movement of the dam were cut away and replaced by concrete masonry, while the openings between the main dam and the guard wall were well filled with cement and concrete. The cut showing the dam as strengthened, Fig. 2, is reproduced from "Engineering," of London, which paper discusses the question as follows, favoring curved dams generally:

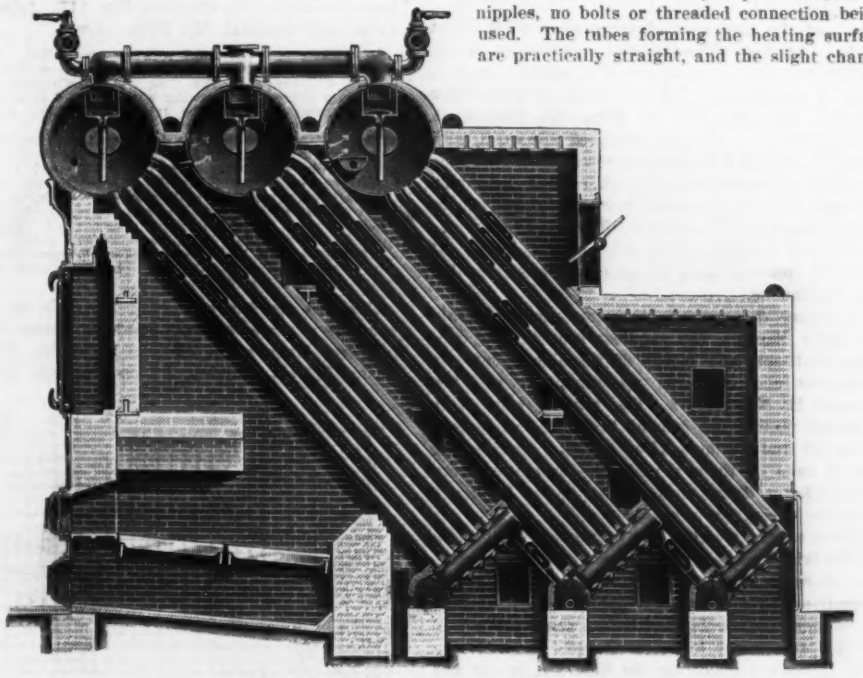
The alterations made are well shown in Fig. 2. The lower portion of the dam was increased in width from 37.5 ft. to 57.3 ft., and abutted on a heavy bressummer sunk down to solid rock. The thickening, however, was not carried up to sufficient height to avoid the objectionable tension on the up-stream face. As the figure shows, the line of resistance lies considerably outside the middle third of the section. There would thus be a tension on the up-stream face tending to open the joints there, and to admit water to the middle of the masonry. The mortar used was apparently not very hydraulic, as to make the dam watertight the whole of its up-stream face had been rendered with a layer of Portland cement 1¼ ins. thick. This rendering must have been considerably cracked during the shifting of the dam; but apart from this, the tension already referred to would also tend to crack it. In all probability, therefore, the structure was water-logged, and during the very severe frost of the past winter, this water, in freezing, would tend to disintegrate the structure, rendering it liable to fall on the first opportunity. An examination of the debris should show whether this view of the matter is well based.

French engineers are not great believers in the theory that the line of pressure of a dam should lie within the middle third of its cross-section. It is perfectly true that existing masonry arches are standing perfectly well, although this line falls well without the middle third, and in the case of the Furens dam there is also some tension on the masonry, but only, if we remember aright, when the dam is empty, the tension being on the down-stream side. It certainly seems advisable, however, to avoid tension on the up-stream face of a dam, as any tendency to the opening of joints there is to be avoided, the more particularly when the cement used is non-hydraulic. When good Portland cement is used, the matter is no doubt less important, but the precaution is at any rate a reasonable one, and we have yet to learn of a failure of a dam in which the line of resistance has been confined to the middle third of the section, in accordance with this view of the matter. The safety of a large reservoir dam should not be compromised by the omission of any reasonable precaution, as repeated experience has shown how disastrous such accidents may be. There is also much to be said in favor of curving a dam in plan. It is true that no great advantage can be shown to exist from a theoretical point of view, and the stability of the famous Bear Valley dam has never been quite satisfactorily accounted for. Nevertheless, quite apart from the support derived from any arch action, the curved plan has an advantage in the fact that there is then no tendency for fissures to form on the down-stream side. When the structure is straight in plan matters are different, and though experience shows that with suitable material very little trouble may be expected from cracks of this nature, the tendency to form them is varied, and may just as well be avoided. The difference in the quantity of material in the case of a straight dam and a curved dam of the same section is insignificant in practice, as the arc and chord subtending an angle of 30°, say, only differs by 4.6%, and this increase might without danger be avoided by slightly reducing the area of cross-section in the case of the curved dam.

Another English paper, "The Engineer," reflects severely upon the responsibility of the French state engineers, who not only inspect such works on completion, but also have them subsequently more or less under supervision. It is said that the condition of the dam was so well known to be critical, that a resident attendant was required to examine it twice a day, and in view of this fact, it is strange that the water in the reservoir should have been allowed to remain at its full depth on the dam. While the state engineers may have believed that the dam was reasonably safe, they must have been aware of the many evidences of weakness and of the suspicion with which the section of the dam was very generally regarded by other engineers. In this connection it is stated that several other dams in France and Algeria will be made the subject of careful investigation as to the safety of their foundations and the strength of their sections.

THE COMBINE WATER TUBE BOILER.

Water tube boilers are coming into more and more extensive use, and we illustrate this week one of the latest patterns, which is known as the Combine boiler, and belongs to the class in which the steam and water drums are placed transversely across the furnace. The cut shows the construction of the boiler, and the circulation in the tubes is indicated by arrows. The standard size of tubes is 4 ins. diameter and 18 ft. long, and they are set at an angle of about 45°, and are expanded at the upper end into the tube sheet in the steam drum, and at the lower end into the tube seats in manifolds. The manifolds for power plants are of open-hearth cast steel, thoroughly annealed. Each manifold has an area almost equal to that of an 8-in. tube. Opposite each tube is a hand hole closed with an inside and outside steel plate, the seat on outside face of manifold and face of outside plate being machined so as to form a perfect joint without packing. The inside plate not only acts as a "crow-foot," but makes a nearly perfect joint with its seat, so that in case of the breakage of the bolt or outside plate, there would be practically no escape of steam. Each manifold is connected to the distributing drum by a 5-in. nipple. For ordinary high pressure



THE COMBINE WATER-TUBE BOILER.

the distributing drums are also of steel, annealed. The sections are connected with each other by short 5-in. circulating tubes set at the same angle as the main tubes, and each distributing drum has a separate blow-off valve. As seen in the accompanying section, the gases have a very long contact with the heating surfaces in their flow from furnace to uptake. The circulation of water and the flow of steam generated in the tubes are upwards in the two forward sections into the two front drums, with ample disengaging space, thence passing to the rear drum (into which the feed is delivered), and downwards in the rear section. The connections between the sections provide for any strain due to expansion. The steam drums rest on a frame of I-beams braced and tied together in such manner as to remove all carrying strains from the tubes.

The cross-section in the cut shows the separator dry pipe in each drum and the feed water sump in the rear drum, the feed pipe being connected to the sump, which is of cast iron, on which is placed loosely a light cast iron cover, which continues to within a short distance of the end of the sump, forcing the feed to travel its entire length, and in so doing to acquire the temperature of the water in the boiler before entering the circulation. It is thereby caused to deposit many of the impurities in solution and suspension, which are removed by the use of the blow-off valve attached for that purpose. Should the deposit in the sump accumulate through inattention to such an extent as might interfere with the passage of the feed through the sump, the loose cover would be forced off by the accumulating pressure of the feed delivery, and thus enable the feed to enter into circulation. Safety valves are attached to the steam header pipes on top of the drums. A tube from any section in this boiler can be removed without interfering with adjoining tubes, and the removal of deposit from the inner surface of the tubes is by introducing a scraper at the lower end through the hand hole, or at the upper end from the steam drum, a specially-designed scraper being used. The smallest steam drum used is 44 ins. diameter, giving ample space for men to operate when cleaning tubes, and the chamber at the lower end is also sufficiently roomy for cleaning. The hand holes in the distributing drums are covered and protected in the same manner as those in the manifold, and the same fittings are used in both cases. Each boiler is shipped in three sections, the section consisting of steam drum, tubes, manifolds and distributing drum. These are assembled and tested at the factory, and only require to be connected at point of erection to form the perfect boiler.

All sections are connected by expanded tubes or nipples, no bolts or threaded connection being used. The tubes forming the heating surface are practically straight, and the slight change in the two tubes in each section, made necessary for alinement in entering the tube holes in the drums, is made at the tube mills during the process of manufacture. The steam and water drums are encased in blocks of "Makite" molded to the radius of drums. The bench formed by the break in the lines of brickwork at the rear of the furnace is utilized for carrying the main flue of a number of batteries, or the stack of one battery or one boiler, reducing very considerably the floor space required. The boiler is built in sizes of 50 HP. to 600 HP., and can carry a working pressure of 200 lbs. per sq. in. It is patented and manufactured by L. M. Moyes, of Philadelphia, Pa., formerly Manager of the Babcock & Wilcox Co.

STANDARD RULES FOR RAILWAY SIGNALING.

At the meeting of the Railway Signaling Club of Chicago held May 7, the Committee on Standard Rules appointed at the April meeting to formulate a code of rules governing the operation of interlocking plants presented a preliminary report, which is abstracted herewith. The committee consisted of Mr. N. D. Miles, Signal Engineer, Michigan Central R. R.; W. C. Nixon, Superintendent of Terminals, Atchison, Topeka & Santa Fe R. R., and H. M. Sperry, Western Representative, National Switch & Signal Co.

(1) Interlocking signals are of the semaphore pattern, consisting of movable arms pointing to the right from posts for trains whose movements they govern for day signals and lights for night signals. The position of the arm or the color of the lights displayed indicates danger, caution or safety.

(2) The home signal, placed at or near the danger point, has one or more arms with straight ends painted red, with white stripe on face side. When arm is in horizontal position or red light displayed, it indicates danger, stop. Signals must not be passed when in this position, except as per Rule 18. When arm is inclined downward to an angle of 60° or more, or a white (green) light displayed, it indicates safety, go on.

(3) High home signals may have two arms on same post. The upper arm governs the movement of trains along the main or high-speed route. The lower arm governs movements of trains along diverging route or routes.

(3a) At junction points, three arms may be used. The upper arm governs movements along the main or high-speed route, the middle arm the route of secondary importance, and the lower arm all other diverging routes.

(4) The low or dwarf home signal has a single arm on a post not over 5 ft. high, and governs movements from side track to side track, side track to main track, and main track movements against the normal direction of traffic.

(5) The distant signal, placed about 1,200 ft. from the home signal, has an arm with forked end painted green on face side, with stripe. When arm is in horizontal position, or a light displayed, it indicates caution, go slowly, prepared to stop at home signal. When arm is inclined downward to an angle of 60° or more, or white (green) light displayed, it indicates safety, go on, or that the home signal or signals for the high-speed route are clear.

(6) The back view of a signal in no case indicates a train movement.

(7) When two or more parallel tracks are to be governed, the signals may be placed on a bracket post. The posts carrying the signals stand in the same relative position as the tracks governed.

(8) Signals are located to the right of the normal direction of traffic on single-bracket posts, or on bridges over the tracks. (Note.—Any exceptions to this rule will be covered by special order.)

(9) Run quite up to home signals, but never beyond them when at danger, except as per Rule 13.

(10) A signal is given for each movement to be made. After receiving a signal to pass in one direction, do not move in opposite direction without receiving the proper signal for such movement.

(11) Movements to or from side tracks or against the normal direction of traffic must be made with train under control.

(12) When arm is not visible, or not inclined downward to an angle of at least 60°, or the light not shown, or a white light shown when a red or green light should be shown, it indicates danger, stop, and train must not proceed until every precaution is taken to insure safety, and the fact properly reported to the superintendent.

(13) If signals are out of order, or if a movement is to be made that is not signaled, train must be brought to a stop and only proceed through the limits of the interlocking by taking every precaution, and in accordance with instructions from towerman..

(14) Flying switches must not be made over interlocking switches.

(15) The use of sand or water must be avoided within the home signal limits of the interlocking.

(16) No engine, train, or portion of train must be allowed to stand for any length of time within the home signal limits of any interlocking plant.

(17) When train has switching to do at an interlocking, trainmen must in no case cut their train in two before stopping, but must bring the train, intact, to a stop outside of the home signal.

THE COMPARATIVE ADHESIVE AND COHESIVE STRENGTH OF CEMENT.

By Louis J. Affelder, Allegheny, Pa., and Robert C. Brown, Pittsburg, Pa., Graduates in the Class of 1894, Western University of Pennsylvania.

(Awarded Second Honorable Mention in Engineering News Thesis Competition of 1894.)

These tests were made to determine the relative adhesive and cohesive strength of both Portland and natural cements. The cements used were "Giant" Portland and "Germania" Portland, and "Union" natural and "Hoffman Rosendale" natural. The "Giant" and "Union" cements were secured direct from the American Cement Works, Egypt, Pa., but the two other brands were ob-

tained from dealers. The adhesion between these cements and each of three kinds of brick was determined—viz., a hard and soft red brick and a fire-brick.

The fineness of the different cements is shown in Table I., as is also the per cent. of water used in gaging to the total quantity of cement and water used. The briquettes for the tensile or cohesive tests were made in aluminum molds, six at a time. It was found that this multiple mold gave better results and entailed less labor in molding than did the ordinary single mold. All briquettes were made of neat cement.

The pieces of brick used were 1½ × 1½ × 2 ins.,

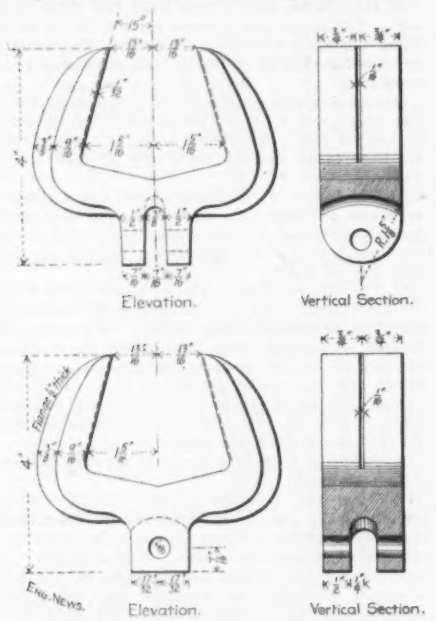


Fig. 1. Details of Clips Used in Testing the Adhesion of Cement to Brick.

and were cut from the commercial brick with a marble saw. To determine the absorption of the different kinds of brick, they were first dried for three weeks and weighed, and then soaked in water for 44 hours, dried four hours and again weighed, and the difference between the first and last weights obtained. This gave the weight of the water absorbed, which, divided by the weight of the dried brick, gave the per cent. of water absorbed. The specific gravity was found by comparing the weight of the dry brick with the weight of an equal volume of water. The following are the absorptions and specific gravities obtained:

Kind of brick.	% water absorbed.	Specific gravity.
Hard red	4.50	2.130
Soft red	8.81	1.981
Fire	5.17	2.000

A Fairbanks testing machine, with two styles

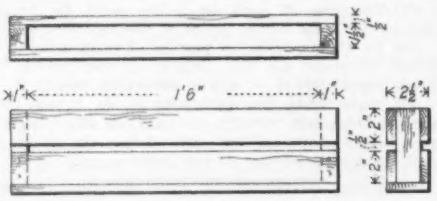


Fig. 2. Details of Frame Work for Holding Bricks in Position During the Setting of the Cement.

of clips, was used for making both the tensile and adhesive tests. The clips for the adhesive tests are shown by Fig. 1. When ready for testing, the combination of two bricks cemented together was placed in the clips in an upright position, the parallel faces next the sides of the clips. Four wedges, which moved in well-lubricated grooves in the middle of the inner side of the clips, were then placed in the clips in an upright position. To give the wedges a good bearing on the brick, thin sheets of lead were introduced between bricks and wedges. The backs of the wedges and surfaces of the lead sheets were deeply scored to increase the friction between them. The machine was then

TABLE I.—Showing Relative Fineness of Cements Tested and Percentage of Water Used in Gag.ng.

Name of cement.	Per cent. rejected, No. 50 sieve, 2,500 meshes to sq. in.	Per cent. rejected, No. 74 sieve, 5,476 meshes to sq. in.	Per cent. water used in gag.ng.
Giant Portland	1.33	4.08	22.54
Germania Portland	1.50	6.09	24.28
Hoffman Rosendale	6.50	7.11	26.86
Union	1.00	3.28	25.76

adjusted, the sliding action of the wedges in the lubricated grooves firmly holding the brick. From this point on the method of pulling corresponded to that of pulling ordinary briquettes.

The cemented surface of the bricks was 2¼ sq. ins., and the thickness of the cement joint about ¼ in. At first difficulty was experienced in applying the cement to so small a surface, and in keeping the upper and lower bricks in line. This obstacle was overcome by using the framework shown in Fig. 2. This was made of pine wood, with all pieces, except A B, firmly screwed in place. The lower brick was put in the trough, cement spread on the upper face, and the upper brick placed on top, care being taken to get it straight. The piece, A B, was then firmly clamped, with the result of having at least the opposite faces of the combination parallel and continuous.

To insure the cement briquettes against breaking other than in the smallest section, the clips were filed out, and pieces of tin placed between briquettes and clips, as recommended by Mr. Spencer B. Newberry.* The tension tests were made by pulling the cement briquettes at periods of 14, 21 and 28 days after gaging. During one day of each of these periods the briquettes were kept under a damp cloth. They were immersed in water during the remainder of the period.

At the same time that the briquettes were molded, the bricks were cemented together. At no time was more cement gaged than would make six briquettes and cement eight bricks together. The bricks were well moistened before the cement was applied, and, after being cemented, received the same treatment regarding the time left in air and water as the briquettes. They were placed in a vertical position, so that only the weight of the upper brick was on the joint.

The results of all the tensile and adhesive tests made are given in Table II. This table explains itself, with the exception of the last column but one. The figures in this column were deduced by dividing the average tension by the average adhesion. From these results it may be inferred:

(1) That the coefficient expressing the relation between cohesion and adhesion is a rather uncertain quantity, varying with the age and quality of the cement;

(2) That it may be greater or less than unity, its highest limit being about 5;

(3) That if materials of nearly equal porosity are cemented together, the coefficient cannot be said to vary directly with that property;

(4) That the coefficient is greater for Portland cement than for natural cements;

(5) That in the case of Portland cements it varies from about 1.5 to 5.0, and with natural cements from 0.5 to 4.5;

(6) That with Portland and natural cements alike, the coefficient decreases with the age;

(7) That the coefficient of natural cements decreases more quickly than that of Portland cements;

(8) That a cement poor in cohesion may be high in adhesion;

(9) That, without doubt, the adhesion in time will equal and even exceed the cohesion.

*"Scientific American Supplement," April 21, 1894.

SEWAGE PURIFICATION IN AMERICA.

(Continued from p. 294.)

Some Details of Cost of Preparing Filter Beds at Brockton, Mass.*

Some of the detailed figures of the cost of preparing the filter beds at Brockton are of interest and may be of general value in estimating on similar work elsewhere, if all the conditions are kept in mind.

The area south of the force main which was grubbed comprised 18.8 acres, of which 14.4 acres were standing pine. The trees varied from 6 to 24 ins. in diameter, about three-fourths of them being less than 12 ins. There were about three trees to the square rod, and when cut up about 35 cords of wood per acre were obtained. The total cost of pulling and disposing of stumps was 70 cts. per sq. rod, or $112 per acre. This would also be about 23 cts. per tree.

The comparative efficiency of handling earth by means of wheelbarrows, which were used on short hauls, and one and two-horse carts is graphically shown by the diagram, Fig. 117. In relation to moving material, Mr. Snow says:

In many cases the haul was up an incline. It was found that a lift as great as 5 ft. per 100 makes no apparent difference in the cost of wheelbarrow work. The time taken in returning without load is six-tenths of the total time of the trip. It is here that the foreman can earn his pay.

The cost of spreading the earth on the embankments, amounting to ¾ ct. per yd., is not included in the diagram. Wheel scrapers were not much used, the number of roots left after grubbing, and the necessity of separating materials, making their use almost impossible. Where they could be used, the cost of a haul of 125 ft. varied from 5 to 8 cts. per cu. yd. One foreman to 16 shovelers was the average rate. Better work would have been done if more foremen had been employed. About 15 yds. were handled each day by every shoveler on the work.

The cost per foot of putting 24-in. vitrified cement pipe in place (average depth not given) was as follows: Excavation, 7.7 cts.; backfilling, 2.7 cts.; laying, 5.9 cts.; calking, 4.2 cts.; cement, 5.5 cts.;

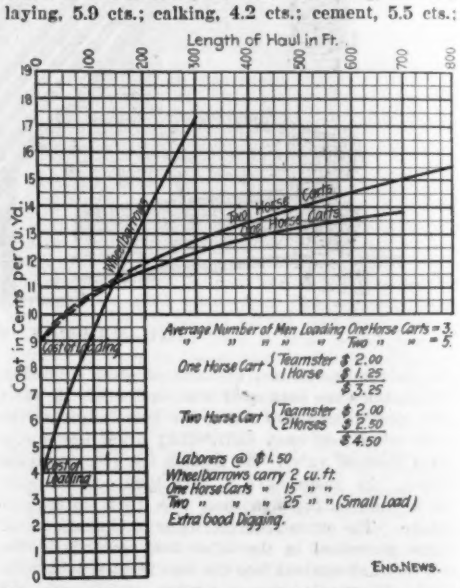

Length of Haul in Ft.
Cost in Cents per Cu. Yd.
Wheelbarrows
Two Horse Carts
One Horse Carts
Hand Loading
Machine Loading
Average Number of Men Loading One Horse Carts = 3.
" " " " Two " " = 5.
One Horse Cart { Teamster $ 2.00 / 1 Horse $ 1.25 / $ 3.25
Two Horse Cart { Teamster $ 2.00 / 2 Horses $ 2.50 / $ 4.50
Laborers @ $ 1.50
Wheelbarrows carry 2 cu. ft.
One Horse Carts " 15 " "
Two " " " 25 " " (Small Load)
Extra Good Digging.
ENG. NEWS.

Fig 117. Relative Efficiency of Wheelbarrows and One and Two-Horse Vehicles in Moving Earth on Brockton Filter Beds.

total, 26 cts. per ft. The pipe gang consisted of one foreman and six laborers. After the trench was ready the gang would lay about 150 ft. of 24-in. pipe a day. A jute gasket soaked in cement paste was placed in the joints. Using two strands a 100-lb. coil will calk 1,000 ft. of 24-in. pipe. A barrel of cement was used for every 40 ft. of 24-in. deep socket pipe.

Regarding underdrains, Mr. Snow gives the following information:

The 12 and 15-in. underdrains were laid by contract, and the smaller drains by time work. The average depth of trench for the larger pipes was 11 ft.; that for the 8 and 8-in. pipe was 7½ and 10 ft., respectively.

*The works were fully described and illustrated in Eng. News for May 2, 1895.

About ¼ cu. yd. of screened gravel was used per foot on the larger, and about 1-12 cu. yd. on the smaller pipe.

The joints of the larger pipes were wrapped with cloth, and the gravel covered with burlap. Cloth costs about 1 ct. per ft. of pipe, and burlap 1¾ cts.

In digging the trench for the smaller pipe no sheeting was used, as was done by the contractor (on the large underdrains—Ed.), but every 10 ft. a section of sand was left, 3 ft. in length, and tunnelled. In this way about one-fifth of the cost of digging was saved. The sections left in acted as braces to the trenches. The total cost of 5 and 8-in. drains, except pipe, was 31 and 51 cts., respectively.

The cost of screening gravel was about 53 cts. per cu. yd. The screenings were about 33% of the total amount of material handled.

USE OF GAS ENGINES TO DRIVE ELECTRIC DYNAMOS, DANBURY, CONN.

By Anson W. Burchard, M. Am. Soc. M. E.

In 1893 it became necessary for the Danbury & Bethel Gas & Electric Light Co. to erect a new electric station. The new station was placed on a site adjoining that of the gas works.

This company manufactures gas by the Edgerton process, in which the retorts used for fixing the oil gas are heated by a producer gas flame; and the apparatus for making this gas is regularly employed in this work. The economical performance of gas engine plants operated by producer gas in Europe led to the belief that a moderate amount of power could be generated by this means at a lower cost than by steam, particularly where water for condensation is not available, as in the case under consideration.

It was found that none of the builders in this country were at that time prepared to furnish engines of larger units than 100 HP., nominal, and three of that size were ordered. They were of the Otto type, two-cylinder, single-acting, the cylinders being placed one over the other, with connecting rods engaging a single crank. On account of the low quality of producer gas and the difficulty of igniting it, it was decided to use electric sparks from an induction coil for this purpose. This plan enables the ignition to be effected at exactly the desired time. The engines are provided with gas, air and exhaust valves of the poppet type, affording facilities for regrinding to maintain tightness. The engines were placed side by side, with crank shafts in line, and to extensions of these shafts there were fitted clutches, so that the engines could be coupled together with the cranks 180° or 120° apart.

Another arrangement was made for coupling the governors, so that by connecting them and the shafts the engines could be run as: (1) A four-cylinder engine with two cranks, 180° apart; (2) a six-cylinder engine with three cranks, 120° apart.

The cylinders being arranged to take gas alternately, with two engines running coupled there were two impulses or two opportunities to govern per revolution, and with three engines running there were three impulses or three opportunities to govern per revolution.

A further provision against irregularity of speed was made in a balance wheel on the countershaft, weighing about 6,600 lbs., and speeded at 485 revolutions per minute.

At first the engines were arranged to regulate the power by either admitting a full charge of gas or cutting it off altogether, as the load increased or diminished. Experiment showed, however, that with the producer gas it was possible by regulating the quantity of gas admitted to the cylinders per impulse to obtain impulses varying considerably in power, that it was possible to ignite a very weak mixture of gas and air, and that the loss of economy due to the use of a reduced charge of gas was not serious; and the engines were subsequently fitted with conical governor cams, by which means the supply of gas per impulse is varied according to the power required, within certain limits, below which the supply of gas is cut off altogether.

This was found to improve the regulation very much as compared with a single engine, or with two or three engines running uncoupled, and as satisfactory regulation could be obtained without coupling the engines, the use of the couplings was abandoned, since they required to be handled with some care, particularly in coupling two engines when in motion. In ordinary service the variation in voltage on the alternating current circuit is not over 2%.

The producer gas used in the engines is made in plain generators, of which there are two in use., each 5 ft. in diameter and 10 ft. high. They are run alternately, the ashes being removed from one on one day and from the other on the following day.

In March, 1894, careful tests of the engines were made. As the power is in a large measure dependent upon the quality of the gas furnished, a standard had to be determined for this. As a large number of analyses made by Mr. H. H. Edgerton, gas engineer of the company, had shown that producer gas of about 156 b. u. per cu. ft., at zero C., and 760 mm. pressure, was the highest which could be made in ordinary producer practice under the most favorable conditions, this was adopted as the standard for the test, and it was intended that they should be made with gas of this composition. A leak from a pipe containing illuminating gas into the producer gas holder raised the power of the gas somewhat above this figure during the first tests, but they are interesting as showing the effect of the richer gas.

Mr. Burchard then described in full detail the careful methods adopted in making the tests. Cards were taken with Crosby indicators at 15-minute intervals, specimens of which are reproduced herewith. The power was measured by a Prony brake, which ran smoothly and gave no trouble in working; and the whole test appears, from the author's description, to have been made in such a manner as to be thoroughly accurate and reliable. Table I. shows the results of this test. Mr. Burchard concluded his paper as follows:

Table II., given herewith, shows the results of the operation of this station from October, 1894, to March, 1895. The figures given in this table were obtained as follows: The current for incandescent lighting is measured by a Thompson wattmeter in the station, through which the entire current passes. The current for arc lighting is taken from the number of lamp hours, which is carefully recorded, and an estimate for the amount of energy consumed by each lamp, based on a number of careful measurements.

The engines are fitted with an attachment by means of which illuminating gas can be substituted for the producer gas without stopping or even reducing the speed. As the illuminating gas is very much more powerful than the producer gas, at times when two engines will not quite carry the load during the daily period of maximum consumption, the illuminating gas is turned on for an hour or two. A record of this gas is kept, and a correction has been applied for the quantity used. The boiler supplying steam to the producer is used to supply steam for other purposes, so that no exact record can be given for the steam used in this manner, but an allowance of 25% has been made for this in the final footings, which is about double that which is generally considered correct.

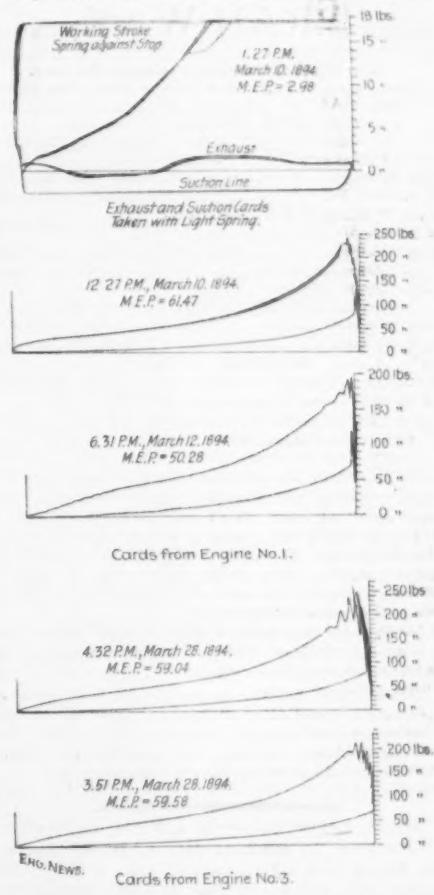
The method of estimating the current sent out from the station in watts is open to criticism, and these figures are given for what they are worth, and not as an exact representation of what can be accomplished by such a motive power equipment as has been described.

The experience with this station may be said to have shown that it is practicable to operate an electric station for which the motive power is furnished by gas engines operated by producer gas, that the liability to interruption to the service will be not much, if any, greater than with steam engines, and that by means of gas engines the fuel consumption in a station requiring a small amount of power can be reduced to a point considerably below that which can be obtained by the use of steam engines.

The items of cost of gas engine power, repairs, depreciation, etc., can be determined only after a longer experience.

TABLE I.—Brake Test of Gas Engines at Electric Station, Danbury & Bethel Gas & Electric Light Co., Danbury, Conn.

Engine No.	Revolutions per min.	Mean effective pressure. Upper cylinder.	Mean effective pressure. Lower cylinder.	Mean effective pressure. Correction.	Mean effective pressure. Average.	Horsepower. Indicated.	Horsepower. Brake.	Mechanical efficiency, %.	Gas used reduced to am't at zero degrees C., cu. ft. per: I. HP.-hour.	Gas used reduced to am't at zero degrees C., cu. ft. per: B. HP.-hour.	Thermal units per cu. ft. gas.	British thermal units per: I. HP.-hour.	British thermal units per: B. HP.-hour.	Thermal efficiency, %. I. HP.	Thermal efficiency, %. B. HP.	Lbs. carbon used per: I. HP.	Lbs. carbon used per: B. HP.
1..	160.26	53.76	59.47	2.90	53.71	92.106	80.305	87.2	87.2	99.6	166.5	14,510	16,570	17.70	15.5	.982	1.121
1..	159.03	56.17	67.32	2.28	59.89	95.24	82.24	86.12	82.6	95.8	161.6	13,348	15,481	19.20	16.06	.9103	1.056
3..	161.7	58.42	58.75	3.19	55.39	95.83	85.801	89.06	85.2	95.2	171.7	14,590	16,300	17.60	15.74	.9611	1.1038
3..	162.51	58.35	59.37	3.19	55.57	95.72	85.95	89.6	87.4	97.3	164.2	14,520	16,160	17.68	15.91	.9183	1.0223
3..	160.6	54.86	60.3	3.19	54.39	93.46	79.58	85.18	84.5	99.1	153.8	12,990	15,210	19.77	16.87	.8065	1.0524
3..	160.1	57.21	62.53	3.19	56.68	97.09	82.78	85 26	86.2	101.1	153.8	13,250	15,550	19.35	16.49	.9146	1.073
3..	166	56.82	56.41	3.19	53.42	94.89	84.40	88.9	87	97.8	151.6	13,180	14,820	19.50	17.31	.951	1.069
3..	165	58.33	60.21	3.19	56.08	98.01	85.32	87.2	91.7	106.3	149.1	13,670	15,900	18.09	16.14	.9537	1.105
Avs.	161.9	.....	.....	....	55.65	95.29	83.3	87.31	86.47	99.02	159.03	13,757	15,748	18.61	16.25	.9319	1.0753



Indicator Cards from 100 HP. Gas Engines, Norwalk, Conn.

TABLE II.—Output and Fuel Consumption, Electric Station, Danbury & Bethel Gas & Electric Light Co., Danbury, Conn.

Date, month.	Output of station in kilowatt hours. Incandescent, by station meter.	Commercial arc—325 watts per lamp.	Street arc—400 watts per lamp.	Total kilowatt hours.	Fuel used by engine. Coal used in producer, lbs.	Illuminating gas used; gas 1,000 B. T. U. per cu. ft.	Equivalent in coal, lbs.	Total coal, lbs.	Watt hours per lb. of coal.	Watt hours per lb. coal, allowing 25% for fuel used in steam boiler.
1894.										
October	5,188.4	744.3	7,646.4	13,579	64,000	29,800	4,470	68,470	198.3	165.3
November	4,724.8	677.3	8,163.6	13,565	62,100	50,000	7,500	69,600	194.9	145.7
December	5,149.4	740.3	9,511.2	15,400	63,900	4,500	675	66,575	231.3	192.7
1895.			425 watts per lamp.							
January	4,038.8	678.9	9,754.2	14,471	73,300	11,400	1,710	75,010	193.0	160.9
			450 watts per lamp.							
February	2,983.8	562.5	7,626.6	11,172	76,400	2,800	420	76,820	145.5	121.2
March	3,097.6	621.4	9,003.6	12,722	66,500	12,300	1,845	68,345	186.2	155.2
Averages	.....	.....	.....	13,485	.....	.....	.....	.....	191.5	159.6

182 days; average output per day, 435,000 watt hours.

* Condensed from a paper presented in the discussion at the April "Engineering Evening" of the American Society of Mechanical Engineers. See Eng. News, April 18.

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With a sorrow deeper than words can express, we announce the death of Mr. A. M. Wellington, our friend and fellow-worker, one of the chief editors and owners of this journal. During his serious illness, which has continued for nearly a year, we in common with all of his many friends, have steadily hoped for and looked forward to his ultimate restoration to health and activity. His own courage and cheerfulness during all these weary months of trial never wavered, and this wrought in us likewise, and in all his friends, hopes which his actual physical condition hardly justified. Thus the news of his death, which came suddenly at the end, is hardly less sudden to us and to his intimate friends than it will be to the many who have known him as an engineer, but have not been aware of the failure of his health.

As one of the chief editors and owners of Engineering News, Mr. Wellington labored hard and successfully for the last eight years in the development of this journal. To him its readers are indebted for many of the features tending to increase its usefulness; for vigorous editorials upon the more prominent engineering works and projects of the times; and for much laborious effort in advancing the interests of engineers that only a journalist can measure and appreciate.

Mr. Wellington was a man of strong personality; an engineer of wide and varied experience; a vigorous writer upon engineering topics and the possessor of a tireless capacity for work. This last was his chief failing, if failing that can be called which had for its ultimate object the benefit of his fellow-men. His indomitable energy and his disregard of himself in any work he undertook, laid the foundation of the disease under which he finally succumbed.

To Mr. Wellington's bereaved family, we, his coworkers (and we can doubtless speak also for all his personal and professional friends), extend the deepest sympathy. The kindest and truest of friends, a loving husband and father, an honorable, upright, conscientious man, he leaves behind him the record of a worthy life, of much good work well and faithfully done.

We are sure that the many personal friends of Mr. Wellington among the readers of this journal, as well as those who knew him only by reputation, will appreciate and value the remarkably good portrait which accompanies this issue as an inset sheet. The engraving has been reproduced from a photograph taken last autumn by Cox, whose reputation for artistic likenesses is worldwide through his work for the "Century" and other prominent literary magazines. Our engraving almost exactly reproduces the photographic print both in color and effect. The hard, sharp contrast between light and shade, shown in ordinary photographs, is eliminated, the deep shadows are softened, and the result is a characteristic portrait, full of expression, whether it be viewed from a distance or close at hand.

The fifteenth annual meeting of the American Water-Works Association, to be held at Atlanta, Ga., May 28-30, promises to be a most interesting occasion. In the "Engineering Societies" column of our last issue the names and authors of the papers to be presented at the convention were published. The list includes three papers on meters, two on electric pumping machinery, and one each on cost of pumping, water supply sources for inland towns, water rights, water-works management, loss of pressure coaused by check valves, and cast iron, steel and wrought iron pipe.

It is greatly to be regretted that the Association has not yet adopted the plan of having the papers to be read put in type and distributed in advance of the meeting. Nearly every engineering society of importance in the country now pursues this course, and the advantages which are gained in the way of greater interest in the meetings and more intelligent and thorough discussions are now so familiar that they need not be enlarged upon here. The Association has done much good work in the past, but it has opportunities to do still better and more important work in the future.

Whether or not it makes the most of these opportunities will depend very largely upon the cooperation of members and officers in efforts to keep pace with the times in all matters affecting the welfare of the association.

Experience with large gas engines for driving electric light dynamos is described in a paper elsewhere in this issue, in which the author shows an average economy in regular service amounting to 191.5 watt-hours per pound of coal. This is certainly a considerably better economy than is shown by any electric lighting stations of such small output which use steam power (see Eng. News, March 14, 1895, p. 164). At the same time the difference is not so great that a small difference in reliability, first cost, cost of repairs, or cost of attendance and management might turn the scale against the gas engine.

On the other hand, it is fair to say that these are the first gas engines of large power to be set to work in this country, and it would not be safe to form any final opinion as to the probable future of the gas engine as a source of power from the examination of this plant alone. The builders of the engines state, in fact, that the engines being built to use either illuminating or producer gas as desired, show a poorer economy than could be obtained if they were especially designed for either. The theoretical possibilities of the gas engine as a more economical device for converting heat into power than the steam engine, have long been known, and it is to be hoped that further attempts to improve its practical efficiency may be successful.

Such experiments as have been made to determine the relation between the adhesive and cohesive strength of cement have done little more than to show that if there is any such relation it is extremely obscure. In this respect the tests described in another column are no exception to those that have been made before. It is, of course, quite within reason that there may be some definite relation between cohesive and adhesive strengths of cement, but it is only by experiment that it can be proved. With the present almost universal system of testing cements by determining their tensile strength, the determination of a definite co-efficient of relation between cohesive and adhesive strength would be of great value, and comprehensive investigations to this end deserve all encouragement. At the same time, to reach results of the greatest practical value, experiments might well be made in a somewhat different direction. Instead of determining the relation between cohesion and adhesion, it would be well to determine the adhesion of cement mortar to various classes of building stones, bricks, and, perhaps, iron and steel. These experiments should be made with careful attention to the effect of variations in the physical qualities of the cement, the character, grain and amount of sand, the amount of water used in gaging, the amount of moisture in the material cemented, the age of the mortar, etc. Such tests could be made on an ordinary tensile testing machine with slight modification of the clips. For the benefit of any possible competitors for our regular thesis prizes who may decide to act upon the above hints, we illustrate here a clip which has been used with unusually satisfactory results by Mr. E. Candlot, the French cement expert. The illustration needs no explanation, except to state that (a) is the cement briquette and (b) the block of stone or brick, to which it is cemented. It will be noticed that the form of the combination briquette, if we may so call it, affords in itself a means of comparing the tensile and adhesive strength of the cement, for, according as the break occurs at the line of junction or in the body of the cement, is the one greater than the other. The bottom clip seems susceptible of some improvement in design, but that we leave to whoever chooses to undertake the experiment.

The avoidance of grade crossings is so comparatively rare a consideration in the original location of a railway in this country that an instance where it is made a fixed rule is worthy of note. In a paper on "The St. Louis Extension of the St. Louis, Keokuk & Northwestern R. R." recently read before the Engineers' Club of St. Louis, Mr. B. L. Crosby stated that through the broken ground of St. Louis county there was a good deal of heavy work, the heaviest cuts being 50 ft. deep, but that all the county roads were carried over or under the tracks. In answer to an inquiry as to whether this was due to natural conditions of topography and profile, or to special design in the location, Mr. Crosby, who was resident engineer of location and construction, stated that the grade lines were purposely laid on the profile so as to avoid grade crossings wherever possible. The topography was favorable to this in some cases, but in others considerable expense was involved. In one case the separation was effected by changing the grade as originally laid out for over 2,000 ft., and permission was obtained from the County Court to cut down the grade of the road, on condition that the railway company would macadamize the road. In one of the two cases where a separation of the grades could not be effected the railway may be able later on to carry the county road under the tracks. The overhead bridges are of cheap construction, with timber bents on each side of the track, stringers 6 × 16 ins. and 30 ins. apart, and 4-in. hard pine flooring. In only one case was an iron road bridge required, and where the roads are crossed by the railway the tracks are carried by 41-ft. plate girders. A more marked and earlier example of this avoidance of grade crossings in the original location of a railway, is the Bound Brook route between Philadelphia and New York, now part of the Reading Railway system. This railway was located in 1872 and opened to traffic in 1876; and much money was expended in crossing over or under country roads and even farm roads. The purpose was the maintenance of a high rate of speed over the new route to New York, and the wisdom of the outlay has been made very apparent in its later operation. When the comparatively flat country traversed is considered, the additional cost, in this case, can be better appreciated.

A. M. Wellington

That most competent authority, Mr. A. R. Spofford, Librarian of Congress, in an article in the May "Forum" on "The Government as a Great Publisher," condemns the existing method of circulating the publications of the government for practically similar reasons to those expressed in this journal on May 9. He points out that, according to a recent report, only about one in eight of the principal libraries in the United States now regularly receives from Congress documents issued for general distribution; and owing to the haphazard method of scattering these documents, whole editions of the most valuable reports printed by the government are exhausted upon unappreciative parties, and not a copy is now attainable for reference even in great libraries. Mr. Spofford, along with every one else who is interested in the subject, is much disappointed in the Printing Bill as passed by the late Congress. Reform in methods had long been urged and promised; but the new bill will effect little, if, any, practical improvement in that direction, and retains, and even adds to, the evils of previous law. An analysis of this bill points out many glaring absurdities. For example, each Senator and Congressman is supposed to distribute each year 1,000 copies of the Agricultural Reports. The Congressmen from New York city may have some trouble, under this ruling, in finding farmers enough in the Bowery and on the East Side to absorb their quotas. Of the abridged messages and documents, an edition of 12,000 copies is provided, though comparatively few of these would be called for; while of the commercially valuable Consular Reports 1,500 copies are supposed to be sufficient. In the latter case the consular agents of the United States have been set to work every where gathering information that is supposed to be highly useful to the public at large, and they perform their work fairly well. But if there is any value in their efforts at all, it lies in the direction of wide circulation. The old system of printing at public expense eulogies on dead Senators and Congressmen is retained; though, with quite as much propriety, the public could be asked to pay the wash bills of living members of the same body. The new bill does provide for the sale of all public documents at cost price; but as long as Congressmen retain the right to scatter these documents among those who do not want and who do not ask for them, the man who does want and would pay for them will generally find "the edition exhausted." That is the common answer now to appreciative applicants, and the new law does not stop the leak. The absolute suppression of the free and promiscuous system of delivery, and the application of the purchase test to all documents printed at public expense, seem to be the only way out of the present absurdly wasteful and unsatisfactory tangle.

Street Cleaning Commissioner Waring, in his late statement to the Mayor of New York city, demonstrated that the streets of this city can be cleaned; but he also clearly shows that to perform this work effectually under present labor and other conditions will cost more money than the Board of Estimate and Apportionment has set aside for this purpose; or $2,384,790 for all the work of the department. Under the laws of 1892 and 1894 the laborers in this service are constituted a favored class, as far as the Commissioner is concerned, by a rigidly fixed rate of wages, in excess of what outside parties pay for similar labor, and regardless of the permanent character of the work. In other words, the Commissioner is compelled to pay more than the market price for labor, and can only economize by reducing his force below the number requisite to perform the work involved. Colonel Waring, however, points out that the Board of Estimate can reduce the rate of pay, if he cannot; and, while he makes no recommendation, he leaves the settlement of this important question to the Board. If the Board takes no action in that direction, the Commissioner says the deficit for the year will be about $500,000.

As street cleaning in New York city is supposed to be established upon a strictly business basis, under the present administration, the protest of Colonel Waring against the limits set about him by the new and foolish labor laws, is timely and should be heard with effect. The average laborer, outside of the department, is injured by the creation of a privileged class of laborers, which cuts down his chances of obtaining any employment, and the taxpayer is injured by being compelled to pay more than similar labor is worth to individual employers. The wages should be high enough to obtain the best class of work; but the fact should also be considered that a satisfactory and steady worker has a practically permanent job, a consideration of much importance in employment of this kind. New York will pay for thoroughly cleaning its streets, whatever that undertaking may legitimately cost; but it should not be asked to pay more than labor of the class required is worth, and the Board of Estimate should take action accordingly. The great majority of the laborers themselves will applaud such action.

ARTHUR MELLEN WELLINGTON.

Arthur Mellen Wellington was born in Waltham, Mass., Dec. 20, 1847. He was descended on his father's side from an old New England family, which had resided on a rocky hillside farm in the town of Lexington, Mass., since Colonial times. In physique he was the very opposite of the typical Yankee, having a sturdy, well-proportioned frame; but his nervous temperament and his never-failing store of energy well indicated his New England ancestry.

Of his early life we know too little; but from our knowledge of the man, it is a safe conjecture that the boy possessed the same restless activity, the same fondness for study, coupled with an impatience and eagerness to reap the fruits of study. He graduated at the Boston Latin School, and then, when only 16 years old, began the study of civil engineering in the old-fashioned way, by apprenticeship to a practicing engineer. For the three years from 1863 to 1866, he was an articled student in the office of John B. Henck, of Boston, well-known to engineers as the author of "Henck's Field-Book." With his work and studies in civil engineering, he still found time, even at that early day, to pay some attention to mechanical engineering, and he passed an examination for a position as Assistant Engineer in the Navy, but was not appointed on account of the ending of the war. His first work in civil engineering after leaving Mr. Henck's office was an engagement in the engineering corps of the Brooklyn Park Department, under Mr. Frederick Law Olmstead, where he served as leveler and assistant engineer. In 1868 he obtained his first position in railway work, a field which was henceforward to a great degree his life work, and in which he was to win a world-wide and enduring fame. This position was on the Blue Ridge R. R. in South Carolina, and he remained there for a year as transitman, having charge of a locating party. He then went to the Dutchess & Columbia R. R. in New York, and for nearly a year served on that road as an assistant engineer. On leaving that road, in 1870, when he was 23 years of age, he was placed in charge of a division on the Buffalo, New York & Philadelphia R. R., and, notwithstanding his youth, he was soon advanced to the position of Principal Assistant. After remaining with this company two and one-half years, he became locating engineer of the Michigan Midland R. R., and later was Engineer-in-Charge of the Toledo, Canada Southern & Detroit R. R.

The panic years of 1873-4 put a sudden stop to railway construction, and Mr. Wellington, in common with hundreds of other engineers, found his occupation gone and no demand for his services in any new position. In his application for membership in the American Society of Civil Engineers, made in 1881, he said:

"1874-'78, was engaged in miscellaneous professional, business and literary occupations more interesting than lucrative and not always particularly interesting." In later years, however, he was accustomed to refer to this period of enforced idleness—so far as idleness was possible to a man of his restless energy—as a blessing in disguise. Hard as it was for the young engineer to leave the professional work in which he was so intensely interested, and in which he was making such satisfactory advancement, it caused him to use his enforced leisure for the study of the broader problems in connection with his profession, and to lay the foundations for the more important work of the later years of his life.

Mr. Wellington's first literary venture was made in 1874, when he was only 27 years of age. It was "The Computation of Earthwork from Diagrams," a book which was the outcome of the methods he had worked out for expediting his own computations in the railways on which he was engaged. This book was very favorably received, and in the intervals during the years 1874-78 when other occupations failed him it was natural that he should again turn his attention in the direction of contributing to the literature of his chosen profession, and upon the subject in which he had had the most experience—railway location. His great work, and that by which his fame as an engineer was firmly established, "The Economic Theory of the Location of Railways," was begun in 1875, as a few notes in preparation for an anticipated location. It was afterward expanded into a magazine article and was first published in the "Railroad Gazette" in the latter part of 1876, as a series of articles on "The Justifiable Expenditure for Improving the Alinement of Railways."

These articles were reprinted in book form in 1877, and the attention of engineers and railway men was at once attracted to their writer as an engineer of uncommon brilliancy and ability.

In 1878, Mr. Wellington accepted the position of Principal Assistant to Mr. Chas. Latimer, Chief Engineer of the New York, Pennsylvania & Ohio Ry., and three years were spent in this position. His duties here were, from one point of view, less to his taste than the work of railway location in which he already had gained experience and reputation. Nevertheless, these three years were spent to excellent advantage, for they gave him an opportunity to gain experience in railway operating details and to acquire a vast fund of information, of which at a later date he made good use.

In the summer of 1878, through the courtesy of Mr. Chas. Paine, then Chief Engineer and General Manager of the Lake Shore & Michigan Southern Ry., Mr. Wellington carried out an extended series of experiments on the resistance of rolling stock, the results of which were presented in a paper read before the American Society of Civil Engineers, Jan. 15, 1879. These experiments were made chiefly by dropping cars down a known grade, and had much influence in establishing formulas for train resistance at low velocities.

In the winter following these train resistance tests, Mr. Wellington carried out a series of tests on journal friction at low velocities, the results of which, however, were not made public until 1884, when they were embodied in a paper read by him before the American Society of Civil Engineers.

It was an excellent illustration of the thoroughness and absorbing interest with which he undertook the solution of any engineering problem, that having made the train resistance tests above noted, and finding in the results some elements of uncertainty, he should plan and carry out in the little leisure which his regular duties gave him a further elaborate series of tests to settle the doubtful points.

After spending three years on the "Nypano," Mr. Wellington was offered in March, 1881, a position as Engineer-in-Charge of Location and Surveys on the various lines of the Mexican National Ry., and he gladly accepted a place so entirely in accord with his tastes. His work on the Mexican National, or some of the most interesting portions of it, were described in a paper read by him before the American Society of Civil Engineers at the summer convention in July, 1886.

During the three years, 1881-'84, Mr. Wellington remained in Mexico, first in the service of the Mexican National Ry., and later Assistant General Manager and Chief Engineer in charge of location of the Mexican Central Ry. under Mr. Rudolph Fink.

But the work of railway location, congenial as it was to him, he was soon to exchange for an occupation still better suited to his tastes and abilities. In 1884, he returned to the United States and entered the field of technical journalism, becoming one of the editors of the "Railroad Gazette." His experience in writing his books, and as a contributor to various journals, had already famil-

iarized him with literary work, and had revealed an exceptional talent for it, and he entered upon his new field of labor with a zeal and ability which at once attracted attention. While upon the staff of the "Gazette," he edited the revised edition of the "Car Builders' Dictionary," in addition to bearing a large share of the burdens of the regular editorial work of the paper, and his leisure, outside of office hours, he devoted to preparing for the press the second edition of his work on "Railway Location," which was finally published in the spring of 1887. On this treatise, more than on any other part of his life's labors, Mr. Wellington's fame as an engineer will doubtless rest. The first edition, published in 1877, to which we have referred above, was a thin little duodecimo of only some 200 odd pages. Nevertheless, we believe that this unpretentious little work, written by the young man with his reputation yet to make, evidences even more the brilliant genius of its author than does the later and much more voluminous work. It must be borne in mind that in 1877, when this first edition was published, there was practically nothing in print of recognized value as a guide to scientific railway location. Mr. Wellington aimed to show in his work that to make a good railway location it was not safe to depend upon blind instinct or rule of thumb, but that all the elements entering into the problem must be taken into consideration and each must be given its proper weight. The value of the work was well proved by the demand for it. The first edition was soon exhausted, and in the years before the second was issued the price for second-hand copies went on climbing higher and higher until as much as $20 was paid, we believe, for a single copy.

The second edition of the work was practically a new book, and while it shows its author's genius little less than the first, the second reveals as the first does not, its author's tireless industry. We feel safe in saying that the American engineering treatises which have embodied as great an amount of labor as "The Economic Theory of the Location of Railways" can be counted on the fingers; and when we add to this that the book was practically all written by the "midnight oil," some idea is gained of the indefatigable energy of its writer.

In January, 1887, some changes were made on the "Railroad Gazette" and Mr. Wellington left that journal and came to Engineering News as one of the editors in chief and part owner. The influence of his energy and ability was at once seen in every department of this journal. Within two years its subscription list had more than doubled, and the paper had become a recognized authority in departments which it had heretofore hardly essayed to touch. Those associated with him are glad to award a large measure of the credit for this rapid development to the talent and never-failing zeal of Mr. Wellington.

In his editorial work he combined in wonderful measure the two valuable qualities of originality and industry, and it is worth noting, by the way, that such a combination is uncommon; the man of genius is apt to shirk the hard work. Mr. Wellington's originality was conspicuous. If he edited a letter for publication in the correspondence column, it was sure to suggest some idea to him which he would add at the end as editorial comment. If he prepared a note for the "Engineering News" page, it was seldom a colorless recital. Some piquant criticism would be thrown in. His industry was measureless; he never dropped a proposed scheme merely on account of the amount of labor involved. If an editorial requiring a great amount of research or the preparation of lengthy tables suggested itself to him, the greatness of the task was never a reason for abandoning it. He seemed to regard it rather as a sort of challenge and undertook it with the greater relish.

It must be said, however, that one good reason for the courage with which he undertook what to others would have been herculean tasks was the lightning speed at which his mind worked. His grasp of a question was instantaneous, and his decision, when a question was presented to him, was given almost as soon as the words were out of the questioner's mouth.

Besides his work on Engineering News, Mr. Wellington found time during the years following 1887 for occasional service as a Consulting Engineer. Among the more important works on which he gave advice were the elimination of grade crossings at Buffalo, the improvement of railway terminals at Toronto and the foundations of the Board of Trade Building in that city. In the summer of 1888 he made an extended examination of the Canadian Pacific Ry. system at the request of President Van Horne, and later gave expert testimony in the famous suit between the company and the Canadian Government, in which the character of the construction taken over by the company was in question. He was a member of the Board of Engineers which examined and approved the estimates of the Nicaragua Canal Co., in 1890. In 1893 he was called before the Massachusetts legislature with reference to the proposed invasion of Boston Common by the West End Street Ry., and at his suggestion the Tremont St. subway, now under construction by the city, was decided upon as the best plan for effecting the desired improvement.

The last work which he undertook as a Consulting Engineer was the improvement of the railway lines in the Island of Jamaica, where he spent two months in the spring of 1893.

We have already referred to the contributions which he made at different times to the "Transactions" of the American Society of Civil Engineers. He became a member of that society in 1881, and was always among its most enthusiastic supporters. At later dates he was elected to membership in the Institution of Civil Engineers, the American Society of Mechanical Engineers, the Canadian Society of Civil Engineers and the Engineers' Club of New York City.

Of the work which engrossed the last two years of his active life we may not speak fully at this time; but as the record of his life would be incomplete without it, we cannot pass it wholly by. In the summer of 1892 he took a vacation of three weeks, but instead of leaving the city, as was his usual custom, he devoted his leisure to working out some ideas in thermodynamics which had occurred to him years before. It was characteristic indeed of the man and of his innate love for work that he chose to spend his leisure in such a manner, rather than in pleasure-seeking of the ordinary sort. The result of his study was the invention of an entirely new type of thermodynamic engine, designed to convert heat into mechanical work with a much smaller percentage of loss than the best existing steam engines. Henceforward the development of his invention became the all-absorbing work of his life, and in his earnestness and zeal all thought of care for his health was forgotten. It had always been his habit to work far into the night when the hours of the day were not sufficient to make satisfactory progress with whatever he had in hand, and he had escaped the penalty which Nature usually exacts for such rashness, largely, we believe, through his happy, sanguine disposition, which made brooding care always a stranger to him, and also through the enthusiasm which made work in accordance with his tastes the greatest of pleasure to him.

But in his labors upon this latest child of his brain, his eagerness was such that he was no longer able to turn his thoughts away from it, even in the few hours which he allowed himself for rest; and there were nights when the dawn of morning found him still busy at his desk. Even his iron constitution could not bear up under such a strain, and early in 1894 he found himself physically unable to go on with his work. His physicians advised entire rest and relief from all care and anxiety, and with the rest came temporary relief, but not, unfortunately, the restoration to a healthy condition of the overtaxed organism.

During the 18 months from the time when the first conception of his invention occurred to him until the failure of his health occurred, Mr. Wellington devoted a steadily increasing share of his time to work upon his invention, and his contributions to the columns of Engineering News became less frequent, until they ceased entirely at the time when he gave up work in May, 1894. He had at that time completed his invention, and had made good progress in experiments looking to its practical and commercial development. How great a trial it was to him to drop work upon it, when it was so near completion, only those closest to him could realize; but the same sanguine and resourceful temperament that had been his stay in every disappointment in life was evident here, and he made his preparations for the European trip which his physicians advised with the same good humor as if it were a mere pleasure journey, and in entire accord with his inclinations.

While traveling in Norway, in August last, his disease suddenly assumed an acute form, and serious hemorrhage of the kidneys occurred, so persistent as to threaten an immediate fatal termination. It was at length arrested, however, and in September he was enough improved in health to return to this country. His malady was a rare and peculiar one, baffling the physician's skill. A period of several weeks in which he would apparently make steady progress toward restored health would be followed by a sudden return of hemorrhage and a loss of more ground than had been gained. Such alternations are even more calculated to depress the spirit than a steady downward progress; but all through these trying months Mr. Wellington's sanguine cheerfulness was never failing. On April 25, at a consultation of physicians, it was decided that an operation for the removal of the diseased kidney was necessary, and it was performed on May 15, with success. But, besides the disease at this point, there was a chronic weakness of the heart, and at 9:30 p. m. on May 16, that organ refused to perform its work.

And now it may be said, what of the man himself, so far as his qualities are not revealed in the above given record of his life? We feel too strongly the inadequacy of this hasty review to do justice to the finer qualities of mind and heart to attempt at this time an extended review of his character. Let us sum it up in this: Those who knew him best, loved him best. He was by nature a man of intense convictions, his standard of right was of the highest, and compromise with anything which did not reach that standard was always difficult for him to make. In every cause that appealed to his interest, his inclination was always to espouse whichever side he believed to be right and labor ardently for its success. With such a temperament, it was natural that he should make occasional enemies, especially among those who knew little or nothing of him personally, and could not therefore understand that no real malice lay behind the quick, cutting remark, the caustic comment or the keen satire from his pen. But to those whose privilege it was to know him intimately, the good-heartedness of the man was always evident.

We have said much of his love of work. Hardly less prominent in his character was his insistence on good work. His quotation from Emerson's Essay on "Worship," with which he closed the introduction to the revised edition of his treatise on "Railway Location" was characteristic of himself. To slight a task was always abhorrent to him, and the desire to do good work for the work's sake and not for the hope of reward was always a controlling motive. It need hardly be said that to such a man strict integrity was an inherent trait.

Such, all too scantily and crudely outlined, were some of the marked personal qualities of Mr. Wellington. That they were appreciated and admired by his many friends among engineers, the letters we have received since the news of his death was made public, bear witness. The work which he did so well and faithfully will be indeed a perpetual monument to his genius and talent; but the excellent and lovable qualities of the man himself are also ineffaceably recorded in the hearts of his many friends.

LETTERS TO THE EDITOR.

A. M. WELLINGTON.

Sir: The profession of civil engineering and the literature of civil engineering, which makes known to the world its achievements, have suffered a great loss by the death of Arthur M. Wellington.

There are very few men living who unite so many qualities necessary to a writer on engineering subjects as he did. He had a tremendous power of industry, which enabled him to collect facts, and his skill in analyzing and presenting them was extraordinary. Although sometimes we might differ from the conclusions that he

drew, we had to admit that there was much to be said on his side.

His "Theory of Railway Location" was a colossal work—a perfect mine of useful information clearly arranged. The accuracy of its statements has, we believe, never been successfully assailed.

The fierce hunger for labor which impelled Mr. Wellington to devote both days and nights to the building up of this great work was, we believe, the primary cause of the sickness which has just led to his death.

It is therefore his monument in every sense, and it marks the grave of one whose memory will not soon be forgotten Thomas C. Clarke.

New York, May 18, 1895.

THE IMPROVEMENT OF THE OKANOGAN RIVER.

Sir: I notice in your issue of May 2 a reference to Mr. C. W. Robinson's article in "Harper's Weekly" on the Tennessee River improvements. In the article he refers to the Okanogan River, and ridicules the idea of its being worthy of improvement, and of its having any "head of navigation," etc. If Mr. Robinson walked across this river within a mile of its mouth and scarcely wet his shoes he must have removed them, for the river is about 250 ft. wide and has water enough to float a good-sized steamer, the "City of Ellensburg," drawing about 4 ft. when loaded, which during certain seasons makes regular trips for a distance of 25 miles up the river.

I send you herewith an official report of an examination of the river made the past year by Lieut. F. R. Shunk, Corps of Engineers, a very careful and conservative man. I have been on the river myself, and know that the statements therein contained are true. Reasons are given in the report why the river is considered worthy of improvement. A very little money will make the river a fairly good watery commercial highway, and give the whole region cheap transportation and be a great aid in its development and prosperity.

I don't know anything personally about the Tennessee River improvements, but I do know that Mr. Robinson's wild and breezy statements regarding the Okanogan River are decidedly unjust, and that its improvement is worthy of being undertaken by the government. This view is concurred in by Col. G. H. Mendell, Division Engineer of the Pacific Coast, and by Gen. Thos. L. Casey, Chief of Engineers, U. S. Army. Very respectfully, Thos. W. Symons,

Captain, Corps of Engineers.

U. S. Engineers' Office, Portland, Ore., May 8, 1895.

(According to the enclosed report of Lieut. F. R. Shunk, referred to, the Okanogan River rises in the Dominion of Canada, and is the outlet of a chain of lakes, of which Lake Okanogan is 60 miles long, 2 to 3 miles wide, and of great depth. The river is 109 miles long, with 75 miles lying in American territory; the drainage area is about 6,300 sq. miles, with 1,860 sq. miles in the United States. The average width of the Okanogan is 250 ft., and it falls 80 ft. in the 75 miles south of the international boundary. To McLaughlins Falls, 45 miles above the point where the Okanogan empties into the Columbia River, the least depth at low-water stage is 2 ft., and that is only found in six places. The difference between high and low-water stages is 10 ft. This river has not been reported for development sooner because until lately it lay within the Columbia and the Colville Indian reservations. These reservations have now been thrown open to the public, and it is expected that occupation of this land will speedily follow, calling for improvement in the river. Mining and stock raising interests would be benefited by better transportation facilities, and the river bed presents few engineering difficulties.—Ed.)

"GIANTS AND GIANTISM IN STEAM SHOVEL WORK."

Sir: In your issue of April 11 I notice a letter from John Souther & Co., entitled "Giants and Giantism in Steam Shovel Work." This letter looks very much like an attempt to belittle the Bucyrus 62½-ton shovel in order to boom another machine. I have no desire to get up a discussion between rival steam shovel builders, as it can serve no useful purpose, but it becomes necessary for me to state some facts in order to prevent misapprehension by those not already acquainted with them.

(1) The kind of material on the hard sections of the Chicago Drainage Canal, which is being worked by these shovels, is not comparable with what is ordinarily classed as steam shovel work, and therefore the records of outputs which may be made under other conditions and quoted by Mr. Souther have no bearing upon the subject.

(2) The record of 594 cu. yds. per 10 hours, which is criticised, is an average for the season, including all delays, such as waiting for cars, blasting, frost and storms in winter, repairs, and from every other cause; furthermore, it is measured in place, which, as every one knows, is only about 70% of car measurement. The work actually done by these shovels is frequently equal to 1,200 cu. yds. per day, and this in harder material than any steam shovel has heretofore worked in, and in which great weight and power are absolutely necessary to do anything at all.

(3) If average records are desired which will compare with those given by Mr. Souther, the Bucyrus machine can easily furnish them, as, for instance, the following: A Bucyrus 35-ton shovel loaded in nine months' work 247,977 cu. yds., engineer's estimate, measured in place, the material being gravel and clay. The average for a single month was 34,000 cu. yds. and the record per hour for total time worked was 134 cu. yds. We might easily produce many other such records, but the foregoing is sufficient to compare with Mr. Souther's records in similar material. It is misleading, however, to compare ordinary steam shovel records with the work done on the hard sections of the Chicago Drainage Canal.

(4) On the Chicago Canal there are 26 steam shovels built by the Bucyrus Steam Shovel & Dredge Co. I have found only two machines on that work built by Mr. Souther's company, and these two were failures. One of these was placed on Section F, where it worked one day, and was removed as being entirely unable to cope with the work. The other one was on Section E, where it worked only a short time and then disappeared.

(5) Mr. Souther concludes with the remark, "There are people who have great faith that we can build a machine for the hard digging on the Chicago Canal that would dig something." Of what value is such a statement in the light of the foregoing facts? Yours respectfully, A. W. Robinson, Chief Engineer,

Bucyrus Steam Shovel & Dredge Co.

South Milwaukee, Wis., May 9, 1895.

TRANSVERSE STRENGTH OF WHITE PINE BRIDGE TIMBER 31 YEARS OLD.

Sir: Previous to the publication of Mr. Onward Bates' valuable paper on "Pine Stringers and Floorbeams for Bridges," in Trans. Am. Soc. C. E., Vol. XXIII., our knowledge of the transverse strength of timber was mostly based on the result of small specimen tests, and engineers engaged in the designing of timber structures often questioned whether equally good results would be obtained in larger sizes. The publication of Mr. Bates' paper, however, definitely settled that point by presenting a record of tests on full-sized bridge members, the sticks, in most cases, being taken from existing bridges, and representing the actual quality of the timber that we are compelled to deal with in proportioning structures.

In extension of Mr. Bates' investigations, the writer herewith presents, in the accompanying table, the results of tests on old white pine bridge timber. The bridge from which the timber was taken was erected in 1864, and has been in constant use during the past 31 years. These tests confirm beyond question the deductions given in the paper referred to above, viz.: "Green timber is not as strong as after it is seasoned." "Age and use do not weaken the timber. It preserves its strength until weakened by decay."

The writer believes that these facts cannot be too forcibly presented, as he has frequently heard the opinion expressed by practical bridge men and engineers that timber, through age, loses its strength, though still sound. The average modulus of rupture of all these tests is considerably higher than the average of any other series of tests that have come under the writer's notice, even that given by Mr. Bates for Oregon fir. The writer attributes this result to the good quality of the timber tested and its dryness when tested. Yours truly,

W. H. Finley,

Engineer of Bridges, Chicago & Northwestern Ry.

Chicago, Ill., May 9, 1895.

Transverse Tests of White Pine Timber Taken from Railway Bridge 31 Years Old.

Reference No.	Cross-section, ins.	Span, ft.	Span, ins.	Breaking load, lbs.	Mod. rup., lbs. per sq. in.	Mod. e.as., lbs. per sq. in.
1.....	7⅞ × 9⅞	8	9½	27,000	5,652	944,000
2.....	7⅞ × 9⅞	7	11	27,980	5,412	715,000
3.....	7⅞ × 7⅞	9	5	29,158	10,616	1,600,000
4.....	7⅞ × 9⅞	9	0	23,370	5,139	1,050,000
5.....	7⅞ × 9⅞	9	4	34,800	7,936	1,300,000
6.....	7⅞ × 7⅞	9	4½	17,000	6,162	1,450,000
7.....	7⅞ × 7⅞	9	5	28,220	10,274	1,900,000
8.....	7⅞ × 7⅞	9	4½	20,400	7,410	1,580,000
9.....	3⅞ × 4⅞	3	4	9,000	6,383	1,200,000
10.....	3⅞ × 4⅞	3	8½	7,000	5,523	880,000
11.....	3⅞ × 4⅞	3	8½	7,000	5,523	880,000
12.....	3⅞ × 4⅞	3	8½	10,870	8,577	1,000,000
A.....	10 × 10	9	3	32,250	5,469	970,000
B.....	10 × 10	9	3	32,770	5,345	995,000
Average tests, 1 to 12, inclusive.....					7,051	1,218,250
" " A and B.....					5,402	982,500

Note.—With the exception of timbers 1 and B, all failed by bottom or tension fibers parting generally at knot, if one existed. Timbers 1 and B failed by shearing along neutral axis. Tests 1 to 12, inclusive, were made on timber from 85-ft. Howe truss span erected over Fond du Lac River, Fond du Lac, Wis., in 1864 and taken down March, 1895. Tests represent full-sized truss members, except 9 to 12, inclusive. Tests A and B were made on timbers selected from the stock on hand in the Chicago & Northwestern Ry. bridge yard at West Chicago, and were well seasoned sticks above the average in quality.

STIFFENERS FOR PLATE GIRDERS.

Sir: In reply to Prof. Johnson's letter, in reference to the plate girder, in your issue of April 25, I would say, first, that in my estimate of "Modern Framed Structures," I do not wish to be misunderstood as underestimating the work of that author who wrote not only the greater but also the more difficult and valuable portions of it.

In paragraph V. of his discussion he states that it is important to remember that the primary stress is a shearing stress, and that all other stresses are logically derivative stresses. This is correct and true, not only for the plate girder but for a Pratt truss or lattice girder.

In paragraph II. he says: "In other words, if we should remove the web plate and substitute only the stiffening angles in a vertical direction, no one would allow that the shearing action of the external forces was properly resisted by the remaining members, which now consist of only the upper and lower flanges and vertical stiffeners"; which, expressed in other words, means, as I understand it, that if we take the main ties out of a pin-connected Pratt truss, the vertical posts cannot carry the vertical shear between the panel points; while if we leave them in, they carry the whole of it at the panel point. This is all true, but I fail to see the connection with the case.

The difference between a flitched beam and a plate girder in which the web is stiffened, is that in the flitched beam the web is stiffened all over, while in the plate girder the web is stiffened in strips at intervals, and these strips have necessarily greater rigidity than the other portions of the web, and therefore the internal stresses in the web would not be the same as when the stiffening is applied uniformly over the whole area of the web.

Now let us take up the case of a girder with inclined stiffeners and assume Prof. Johnson's analysis correct. The internal stresses are then tensile and compressive, acting at an angle of 45°. The stiffener is rigidly connected to the web by rivets, and the web is strained in compression along the line of the stiffener.

Since the plate is elastic, there will be distortion or strain in proportion to the stress and as the stiffener is rigidly connected to the web, it must also be strained by an amount equal to the strain or distortion of the plate. From this it would appear that the stiffener must act with the plate.

Applying proposition III. to this girder, the path of greatest rigidity would be the line diagram of a Warren girder, and the inference I should draw would be that the web stresses, while acting at an angle of 45°, are not uniformly distributed, but are concentrated with greater intensity along the line of greatest rigidity.

This same conclusion I should hold to apply to a girder with vertical stiffeners, the difference being in this case that the path or line of greatest rigidity having changed somewhat in direction, the line of maximum intensity of the internal stresses would change direction with it.

We seem to have agreed upon the truth of proposition III., and also as regards shear, and our difference hinges solely upon the method of applying the proposition.

I am unable to see the point of distinction between a stiffener under a concentrated load which has the ability to act with the web and carry shear from one part to another, according to Prof. Johnson, and the intermediate stiffener which he claims has not, since each is similar and connected to the web in substantially the same manner by rivets driven by the same machine.

Finally, it would seem that, in considering a plate girder with a stiffened web, since the stiffeners and the web plate are essential to the existence of such a girder, proposition III. must be applied to the web with the stiffeners connected, if we wish to determine the nature of the internal stresses therein correctly.

I am indebted to Mr. W. Whited for the proof that the stiffener acts with the web by virtue of the distortion of the web under stress. Respectfully yours,

C. A. P. Turner.

East Berlin, Conn., May 2, 1895.

Sir: In your issue of April 25 Prof. J. B. Johnson sets forth very clearly, it seems to me, the true function of web stiffeners in a plate girder.

The question of vertical or inclined stiffeners is an old one among bridge designers, and the advocates of the vertical system seem to have the support of almost universal practice.

It is probable that a pair of stiffeners, properly riveted together through the web, will prevent a corrugation from forming, or straighten out one that has

formed just as well if it crosses the axis of the corrugation at 45° as though it crossed it at right angles. The point to be assumed is, what length of corrugation along its axis it is safe to leave unsupported. A common formula for unit shear in webs is

$$f = \frac{A}{1 + \frac{d^2}{a\,t^2}}$$

where A and a are assumed constants, d is the clear distance between flange angles or stiffeners, and t is the thickness of web.

If we grant that the corrugations of a weak web plate would be in parallel lines, making angles of 45° with the horizontal, their unsupported length allowed by the formula would be $d\sqrt{2}$. If the stiffeners are at 45°, their distances apart at right angles may be $d\sqrt{2}$. and, measured horizontally, 2 d, or twice the spacing of vertical ones. If D is the vertical depth of the girder covered by stiffeners, the length of the inclined ones will be $D\sqrt{2}$ and the length per unit of length of girder $\frac{D\sqrt{2}}{2\,d}$, while for vertical stiffeners we have $\frac{D}{d}$; that is, the amount of material in the inclined stiffeners will be about $\frac{7}{10}$ that required in the vertical ones.

This saving in material is the argument in favor of inclined stiffeners. Against this can be cited many objections. A girder carrying a load must have the load brought on it in some way; either directly on the top flange or by attachments to the web. If by the former the web stiffeners should lap on to the top flange angles, if by the latter the attachments must needs be vertical or horizontal, neither of which combine well with inclined members. In case the load is on the top flange it is often desired to make a contact fit between the outstanding leg of the stiffeners and the horizontal leg of the top flange angle; an inclined stiffener precludes this. At the ends of the girder inclined stiffeners would make an awkward and ineffective connection with the end uprights, the office of which Prof. Johnson so well defines. Proper considerations of good workmanship would require the ends of inclined angles to be cut oblique. The waste in doing this and the objection to making a "back cut" would count for something. In the matter of appearance also, I think the advantage would be largely with the vertical stiffeners.

Whether or not the objections cited outweigh the economy of material is for each designer to decide for the particular case that he has in hand. It seems to me that the matter is quite parallel to the principle of the Post truss and very likely to follow the same course. Respectfully yours, J. P. Snow.

Boston, Mass., May 4, 1895.

THE LAST OF THE INDESTRUCTIBLE PILE & PIER CO.

Sir: I notice a reference in your issue of this week to the Indestructible Pile & Pier Co. Enclosed find a copy of the proclamation of the Governor of New Jersey declaring its charter forfeited. Yours truly,

W. C. F.

New York, May 17, 1895.

(So it appears the company was not indestructible after all.—Ed.)

A LETTER FROM MR. DELAFIELD.

Sir: In your editorial of May 16 you have unintentionally done me a grave injustice, from a misapprehension of facts, which I am confident you will redress upon hearing a statement of the truth of the whole matter.

Some years ago I obtained a patent for an "indestructible pile," which I believed to be a good design and valuable. To exploit the same, I unfortunately associated myself with Geo. W. Dunn, who agreed to form a company and furnish the necessary funds to place it upon a substantial basis. A company was formed, but Mr. Dunn failed to furnish the funds necessary to make the company a success.

About a year and a half ago I was surprised to find Dunn attempting to sell stock, using my name as a stockholder in his advertisements. He was promptly notified not to use my name, and the matter dropped. Six weeks ago my attention was called to a craftily written advertisement of the same scheme, using my name again. I at once placed the matter in the hands of my attorney, Mr. Edward B. Merrill, who called on Dunn and absolutely forbade the use of my name, and Dunn promised that it should not be used again. An application to the Attorney-General of New Jersey disclosed the fact that the company had been enjoined from operating in 1893 for non-payment of taxes, and that its charter had been declared null and void by the Governor in May, 1895, for the same reason. This gave me an opportunity of which I have availed myself to place the matter in the hands of the Inspector of United States Mails and of the District Attorney of the city of New York to stop Dunn from any further attempt to obtain money under false pretenses. His victims, if they could be found, would be better able to bring him to justice, however, than I.

I doubt if any man whose name is used in these advertisements as a large stockholder has either knowledge of the present condition of the company or of the use of his name in connection with it.

I have neither a share of the stock nor have I received a dollar from this "Indestructible Pile & Pier Co." I heartily agree with you as to the status of an engineer, and through a long life have tried, both in private life and as an engineer, to be above reproach, and to those who know me I confidently refer as to my character. No man is safe if his name may be used without warrant and in spite of his earnest protest to give character to a fraudulent enterprise.

My counsel, Mr. Edward B. Merrill, Mutual Life Building, has done all in his power to prevent this man from using my name, and will certify, if needed, to my statements as correct.

Clarence Delafield, C. E.

No. 1 Broadway, New York city, May 21, 1895.

(We are pleased to give space to Mr. Delafield's letter, and shall feel well repaid for the attention we have given to this matter if it results in the punishment of whoever is responsible for the use of the name of the American Society of Civil Engineers in connection with a fraudulent enterprise, as it appears likely to do. We cannot agree with Mr. Delafield as to there being any value in his invention of an "indestructible" pile, and as we showed in our issue of Feb. 15, 1894, his patent upon it was valueless in any event; but experience keeps a dear school, and he has learned in it the danger of letting a worthless patent bearing his name go into irresponsible hands.

There is another lesson to be learned from this matter, and that is that it is the duty of every good citizen to aid in the enforcement of law and the punishment of crime by every means in his power. Had Mr. Delafield not rested 18 months ago with forbidding the use of his name in connection with this scheme, but had he then set the machinery of law in motion, as he has now, he would have saved a deal of harm to himself and to others. —Ed.)

THE INSTRUCTIONS TO PUBLIC LAND SURVEYORS.

Sir: In your issue of March 21 was given some information concerning contracts for surveys of government lands. Although this work is not generally sought by engineers, a man trained and experienced in good work may find nothing better to do than to take a contract. I believe that no one yet has carried out the terms of the same as set forth in the "Manual" issued by the General Land Office. The law simply requires that the public lands shall be divided into townships of 6 miles square, which are subdivided into sections of 1 mile square; standard parallels and meridians are run every 24 miles. This appears to be a simple proceeding, but the "office surveyors" of the General Land Office do not so consider it. The "Manual" has lately been enlarged to 240 pp., octavo, of which 120 pp. are instructions proper, the remainder consists of specimen field notes, etc., the whole being a ludicrous combination of Coast Survey accuracy in getting correct angles and azimuths with country surveyors' methods of chaining. "Township and subdivision lines shall be usually measured with a 2-pole chain." On sloping ground the chain is leveled by eye and the pins dropped. (No plumb bobs mentioned.) The "Specimen Field Notes" contain the following:

Survey executed with a —— light mountain transit. . . . Begin at a stake 3.39 ft. south of Twp. cor. (Note.—This corner may be either a rough stone, a wooden post or a mound of earth.) . . . I lay off a true meridian, from an observation of Polaris (particulars given above), and turn from the said meridian an angle of 89° 57′ 20.9″ to the east and run . . . etc., etc.

The chainmen then proceed with the two-pole chain. When township lines are projected across an unsurveyed district from opposite directions and fail to meet, the error is dignified with the name of "Hiatus." Two pages are occupied with directions for distributing such error.

In subdividing townships (with open-sight compass) the instructions are particularly vexatious, requiring that the survey shall be extended from the S. W. corner of Section 36, running north one mile, then east one mile; then, after correcting closing error of the line run east, another mile is run north, and east; and so on, jogging all over the township. The surveyor is required to note changes of the variation of the needle as he proceeds with his daily work. How he is to discover them when running over rough ground or in timber where no back sight can be had, or read the needle for 3′ or 4′ is left to the imagination. The Specimen Field Notes give the following: "At 10 a. m. diurnal change has reduced variation by 4′." . . . "At this point the variation increases on account of local attraction," etc. Although such apparent accuracy is required in getting true bearings, when the line runs into a big tree the surveyor is allowed to move his compass to the other side of it, guess at his line, and proceed. A certain number of observations of Polaris are required to ascertain the variation, etc., which are impossible to take in rainy weather.

A portion of the instructions of the "Manual" are practicable in a flat country, but in the heavily timbered and mountainous portions of Oregon and Washington, where it is cloudy for over a month at a time, the deputy surveyor gets through any way he can, makes up fictitious observations of Polaris and inserts them in the proper place in his notes; puts in enough 3′ or 4′ diurnal changes to look well, and writes up his notes so that they indicate that he jogged over the township in the approved manner.

Before beginning work the deputy takes an oath to discharge his duties in strict conformity with the manual; and after completion, another oath that he has done so. The chainman, axemen and mound builders are required to take similar oaths. The deputy must run the instrument over all the work; no transitman or compassman may be employed. This clause of the contract is generally violated, as it is usually cheaper to have more than one field party in subdividing a township. The dates of each day's work are accordingly "cooked," so that the notes do not show that the deputy was working at difference places at the same time.

On the whole, the field work in Oregon and Washington is done very inaccurately, although well enough in consideration of the low value of the land in newly settled districts. The prices per mile are totally inadequate to the precision of work required by the manual (except on subdivision lines). I have seen contracts for a guide meridian, and other work, at the price of $20 to $25 per mile, requiring a transit line to be run, each hub double-centered, and chained twice. This was in a mountainous country, covered with thick timber, brush and windfall. The trees would average over 2 ft. in diameter, and the deputy would run into one every two or three hundred feet. This contract was never completed.

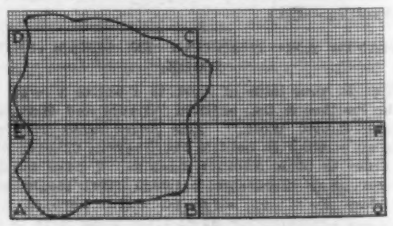
The General Land Office may keep on adding unnecessary refinements to their manual, but better work will not be done till they are willing to pay more. The Surveyors-General are usually chosen for political ability, and the chief clerk draws up the contracts. In all cases I have known, the deputy was obliged to wait for his pay from six months to a year and a half, although there is no reason for more than two months' delay in inspecting the work and copying his field notes. I have known of tips paid to the clerks to "hurry" the notes along after the deputy had waited six months or so and received no returns for his work.

If a practical man who had had actual experience in the rougher class of this surveying were engaged to write brief instructions, omitting all the vexations and unnecessary "chicken fixin's," the work would be as well done, and deputies would not have to swear to a few dozen lies every time they took a contract.

M. Am. Soc. C. E.

DETERMINING PROPER SETTING FOR PLANIMETERS.

Sir: In working with the planimeter, it is desirable to use such a length of tracer arm as will give areas direct, thus avoiding the necessity of multiplying or dividing the instrumental result by a constant. Theoretically, the determination of the proper setting for tracer arm is a simple matter, when once the constant of the instrument for natural scale (1:1) has



been determined, involving only the solution of a simple proportion. But if the linear scale of the plat to be measured is not a simple ratio, or if the plat is made on cross-section paper and with different horizontal and vertical scales, the numerical work of solving this proportion may be considerable. Again, areas must often be determined from sheets that have shrunk or enlarged since the areas were plotted, so that while the original scale may have been a very

simple ratio, the actual scale at the time of taking off the area will be a complex one. The cross-section paper furnished by the trade is seldom exact, and is generally in error by different amounts in the transverse and longitudinal directions. A plat made on such paper will be to a complex scale, when the scale would be a simple one for correct cross-section paper.

In practice the observer, after computing an approximate setting for tracer arm from the alleged area scale of the plat, may proceed in two ways. A line or lines of known length may be scaled from the plat; from the values found, the error in the alleged area scale will follow, and from this the correction to the approximate setting may be computed. Or the tracer arm may be set at the approximate value, found as above, and a known area on the plat measured with the instrument. Then if the area given by the instrument differs from the known value, the tracer arm is lengthened or shortened in the ratio of this difference to the instrumental area.

From the foregoing it appears that for a careful determination of setting for tracer arm, the calculations must be supplemented by actual observations on the plat; hence a rule for determining the setting by observation alone would be of practical value, if of easy application. It is here purposed to develop a rule having this end in view. The fundamental equation for planimeters, both polar and rolling, is of the following general form:

$I = \frac{C}{T} A$. In which I is the area given by planimeter for a figure whose area by scale is A. T is the length of tracer arm used in getting the result I. C is a constant (for a given planimeter) for all plats made to the same scale. Suppose that on the sheet from which areas are to be measured there is a known area, A', plotted to same scale as the unknown areas. Suppose the tracer arm set at a length T' numerically equal to A', and the plotted area A' measured with the planimeter. Then

$$1' \frac{C}{T'} A' = C \frac{A'}{T'}$$

But T' = A' (numerically); hence I' = C (numerically).

Now suppose the tracer arm set at a length T'' numerically equal to I', and that any area A'' plotted to same scale as A' is measured with instrument. Then

$$I'' = \frac{C}{T''} A''$$

But T'' = I' (numerically) = C; hence I'' = A''.

That is, the area given by the instrument is equal to the area required. Hence, the following rule:

Select a known area on the sheet for which the setting is to be determined. Make the length of tracer arm equal, numerically, to this known area, and measure the plat of that area with the planimeter. The area given by the instrument will be numerically equal to the required setting for tracer arm. For the convenient application of this rule, there should be a scale of equal parts on the tracer arm.

Example—It was required to set a rolling planimeter to read direct the areas of a number of irregular figures, similar to the one shown herewith, all plotted on millimeter (±) cross-section paper to a scale of 1 : 200, vertically; and 1 : 2,000, horizontally.

The square A B C D, 50 mm. × 50 mm. and 1,000 square meters in area (by scale) was measured several times with the planimeter, the tracer arm being set to read 1,000. The mean result given by the instrument as the area of A B C D was 1,368. Setting tracer arm to read 1,368, the area, A E F G (= 1,000 square meters), was measured twice with the planimeter, giving a mean result of 998.6 square meters. One result was in excess of 1,000 and one in deficiency. The error may, therefore, be referred to accidental causes, rather than to an erroneous length of tracer arm, as this would tend to make both results excessive or both deficient. The constant for this planimeter for natural scale—to express areas in square millimeters—is 539.6. Hence, for the above area scale $\left(\frac{1}{200} \times \frac{1}{2{,}000}\right)$ the setting to give areas in square meters would be $\frac{539{,}600{,}000}{400{,}000} = 1{,}349$ for a correct sheet of cross-section paper. The paper was tested and found to be incorrect. In determining the setting 1,368 by trial, the instrument itself took care of the inaccuracy of the paper.

The above rule can, of course, be used to determine the constant of a planimeter for natural scale. Thus with a certain rolling planimeter, the arm was set to read 7,840 and the tracing point carried over the circumference of a circle 7,840 sq. mm. in area (50 mm. radius). The area given by the planimeter was 539.6. The value for the constant, as furnished by the makers, was 539.4.

While the setting of tracer arm, giving equality between instrumental and actual areas, can generally be used, it is sometimes necessary or convenient to use another setting. The setting for equality of areas may exceed the total length of the tracer arm; or, on the other hand, it may be so small as to give a tracer arm too short for rapid, or accurate work. Under such circumstances a setting should be used which is some simple factor or multiple of the setting for equality; in which cases the areas sought will be like factors or multiples of the instrumental results.

Respectfully, T. C. Thomas.

Vicksburg, Miss., April 8, 1895.

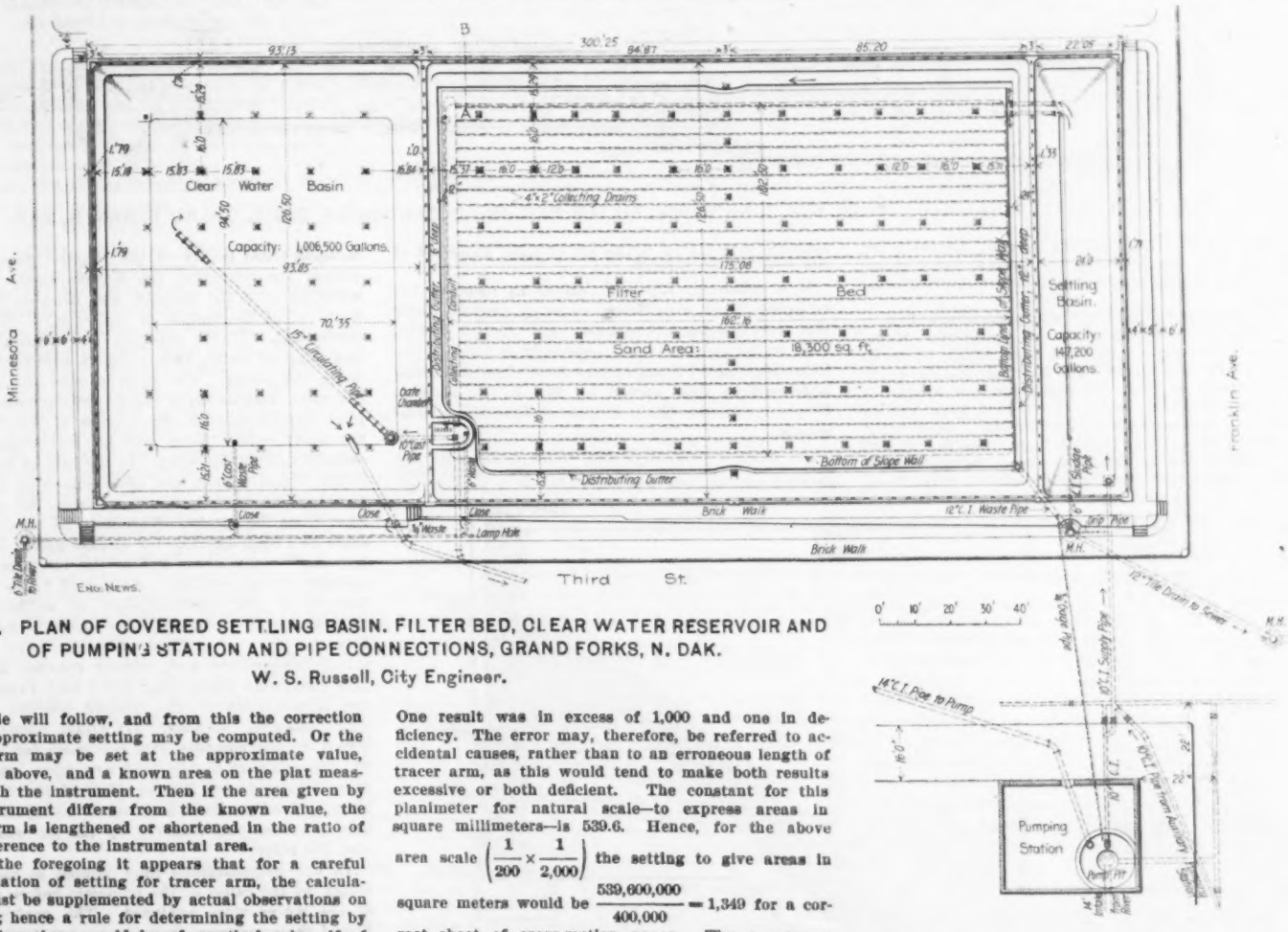


FIG. 37. PLAN OF COVERED SETTLING BASIN. FILTER BED, CLEAR WATER RESERVOIR AND OF PUMPING STATION AND PIPE CONNECTIONS, GRAND FORKS, N. DAK.

W. S. Russell, City Engineer.

NOTES AND QUERIES.

E. M. N. asks: "Can you or any of your readers give me any information relative to sand washing machines?" We have ourselves endeavored to obtain some information concerning machines of this class. If any of our readers can furnish particulars, they will oblige us as well as E. M. N.

One bowlder, 28 × 30 × 20 ft., found near Waterloo, Ia., has furnished all the stone for building a handsome and large church at that place. Good stone is scarce in that region and this glacier-transported bowlder was utilized for this reason.

WATER PURIFICATION IN AMERICA.

(Continued from p. 94.)

Covered Sand Filter Beds at Grand Forks, N. Dak.

The sand filtration plant for the water-works of Grand Forks is the third filter plant to be built along the lines of the Lawrence experiments.* It has a watertight bottom, and is roofed over and is placed between settling and clear water basins, which are also covered.

The establishment of this plant was the outgrowth of a serious typhoid epidemic in the winter of 1893-4. The population of Grand Forks in 1890 was 4,979, having increased to this figure from 1,705 in 1880. Water-works were built by the city in 1882. The supply, until the erection of the filter plant, was pumped directly to the mains from the Red Lake River.

Mr. W. S. Russell, City Engineer of Grand Forks, was the engineer for the filter plant, and we are indebted to him for the drawings from which the accompanying illustrations were made, and also for much of the information given below. Regarding the reasons for constructing the filter and the prevalency of typhoid fever in Grand Forks before and after the epidemic, Mr. Russell wrote us as follows on April 15:

> You are right in assuming that the typhoid epidemic was the immediate cause of our putting in the filter at this time, although the matter of filtering our water supply had been under consideration for a number of years, and we at one time went so far as to solicit bids from manufacturers of mechanical filters. The expense, however, was so great that the only conclusion arrived at was, that it was impossible for us to raise the money to pay for such a plant.
>
> We have always had considerable typhoid fever, some seasons more than others, never sufficient to cause any great alarm or investigation of the cause until the epidemic of 1893-4. There were no records made until the fall of 1893. The following is a copy of the record showing the number of cases of typhoid

* See Eng. News, Aug. 3, 1893, and Aug. 23, 1894, for descriptions of the plants for the cities of Lawrence, Mass., and Mount Vernon, N. Y.

fever and deaths therefrom, from November, 1893, to date:

Months.	Cases.	Deaths.	Months.	Cases.	Deaths.
November	2	0	August	4	0
December	230	4	September	10	0
January	412	52	October	1	2
February	231	27	November	0	0
March	46	11	December	1	0
April	26	2	January	0	0
May	1	0	February	0	0
June	3	0	March	1*	0
July	2	1	April	1**	0

* From Northwood. ** From Walle.

During the Grand Forks epidemic we wrote Mr. A. D. Stephens, Mayor of Crookston, for information regarding the situation there, and received the following answer:

In reply to yours of Feb. 28, 1894, will say that we have not really had a typhoid fever epidemic in this city. There have been half a dozen cases only, outside of several cases in the hospital, which were brought in from abroad.

We do not think it has any connection with our water supply, as nearly all the water used is artesian well water, although the few cases we have had can

drinking water. None of our towns in the Red River valley have a complete system of sewers and water supply. We have not been able to trace the origin of the disease to any public water supply, but chiefly to unsanitary local conditions. Its transmission has been largely through railroad, lumber, harvest and other camps.

Given a city with a typhoid epidemic, and a water supply contaminated by the sewage of communities known to be suffering with typhoid, how can but one inference be drawn? Absolute proof of cause and effect may be impossible, but

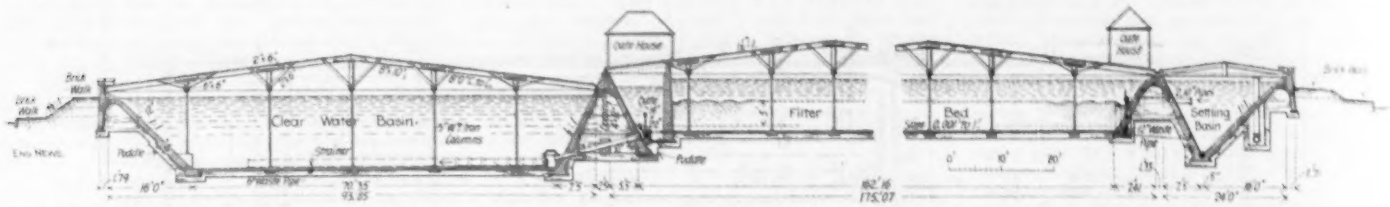


FIG. 33. LONGITUDINAL SECTION OF SETTLING BASIN, FILTER BED AND CLEAR WATER BASIN, GRAND FORKS, N. DAK.

You will note that since the starting of the filter, Jan. 5, 1895, we have had no typhoid fever, except two cases, which were brought here sick from other towns.

The cause of our epidemic was undoubtedly directly attributable to a lesser one at Crookston, Minn., which is situated on the Red Lake River, about 60 miles above us by river. The best information which I can obtain is from the physicians and health officer in Crookston, which shows that they had in their city during October and November, 1893, something over 60 cases of typhoid fever. The fall of 1892 the main sewer in Crookston, there being but one main, was broken down and completely stopped by

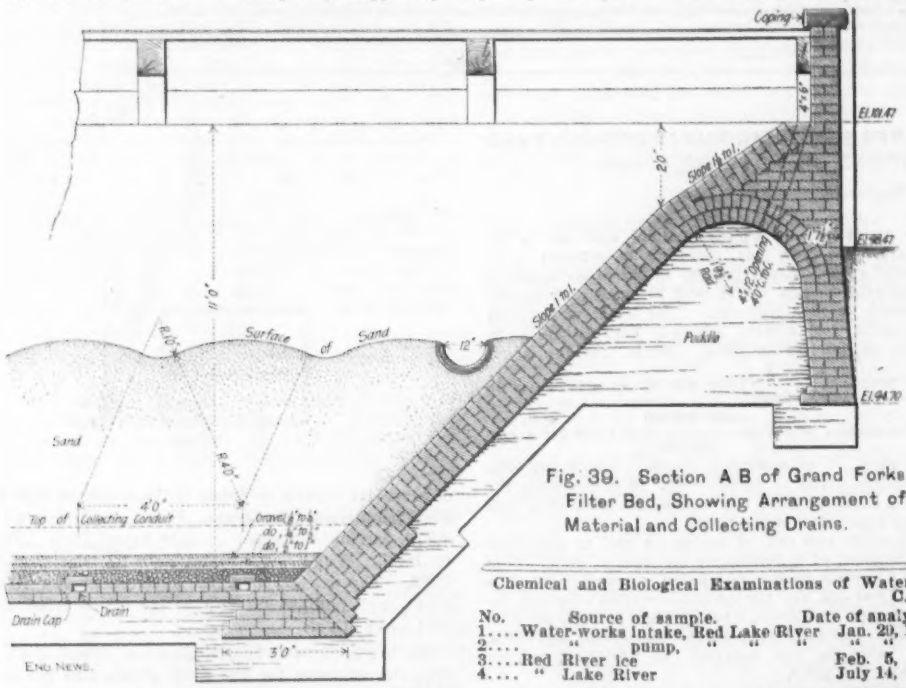


Fig. 39. Section A B of Grand Forks Filter Bed, Showing Arrangement of Material and Collecting Drains.

the settlement of the railway embankment. From that time to Nov. 16, 1893, the effluent was pumped from their sewers over the embankment into the river with a 4-in. centrifugal pump, which was so placed that it was impossible to remove much, if any, of the sludge. On the last-named date, at which time the river was frozen over solid, the city completed a new outlet for their sewers. On Nov. 17 the entire sewer system of Crookston was flushed, and the above record, kept by our Board of Health, I believe shows the result. I am very sorry that I cannot give you the exact number of cases for the previous years. Before the epidemic we had no board of health other than a committee of the council, which kept no record.

Jan. 1, 1894, the Health Board was created under the state law, which provides that one practicing physician and the city engineer of each incorporated city and four of the aldermen, appointed by the mayor, shall constitute the local board of health. It is my opinion, based upon conversation with physicians and observation, that the average number of cases of typhoid fever per annum for the last ten or twelve years would not be less than 30; some years there were far more than others, and the average might exceed that number. Of the number of deaths I have but very little idea.

apparently be traced to the use of river water out of the water-works system.

It is commonly reported that at the time of the epidemic there were many cases of typhoid along the river between Crookston and Grand Forks. This seems very probable, especially in view of the following extract from a letter dated April 23, 1895, addressed to this journal by Mr. C. N. Hewitt, Secretary of the State Board of Health of Minnesota:

The disease, ever since the white settlement, has been endemic in the Red River valley, even when sparsely settled, and was associated with the surface

common-sense points to the impure water as the vehicle for conveying the disease germs to those suffering with the malady, and dictates the abandonment of the supply or the removal of its contamination. If the pollution be sufficiently gross and near at hand, this alone is sufficient to condemn the water. The more remote the pollution, the more chances there are for the decrease or complete annihilation of the sources of infection, and the more reason there will be for calling in the chemist and the biologist. In the case of the Grand Forks water supply, the main source of pollution, as has been shown, was Crookston, 60 miles by river from the intake. This may be considered by some as a long distance for disease germs to travel, but the circumstances before the inception of the epidemic were peculiar. As stated above by Mr. Russell, a large accumulation of sediment from the sewage of Crookston was suddenly discharged into the river at a time when the latter was at a low temperature and entirely covered with ice, two conditions which may have been favorable to the transmission of the typhoid bacillus through long distances, because: (1) Other forms of life which usually compete with this germ for existence by devouring available food are more susceptible than it to cold; and (2) the effect of direct sunlight upon typhoid germs is believed to be injurious, and this influence was removed by the ice which covered the river.

All the circumstances thus pointed to the water supply as the cause of the epidemic before samples of the water were analyzed. The analyses confirmed the suspicions, probably as completely as has ever been the case with a water supply alleged to be the cause of typhoid. One of the foremost investigators in this line, Professor Vaughan, stated that he had identified from this water a germ which

Chemical and Biological Examinations of Water and Ice from Grand Forks, N. Dak., Made by Prof. V. C. Vaughan.

No.	Source of sample.	Date of analysis.
1	Water-works intake, Red Lake River	Jan. 29, 1894
2	" pump, " "	" " "
3	Red River ice	Feb. 5, "
4	" Lake River	July 14, "
5	Red Lake River	July 14, 1894
6	" River	" " "
7	" "	" " "
8	Hydrant	Feb. 2, 1895

Chemical Examination; Parts per 100,000.

	Sample number.							
	1.	2.	3.	4.	5.	6.	7.	8.
Total residue	24.000	24.000	4.0000	28.000	24.0000	30.000	31.200	31.000
Loss on ignition	12.000	12.100	2.2000	6.000	1.5000	2.500	2.200	7.000
Chlorine	0.160	0.160	0.2000	0.160	0.1200	0.130	0.130	0.181
Oxygen consumed	0.410	0.440	0.0900	0.480	0.4200	0.510	0.490	0.400
Free ammonia	0.002	0.017	0.0005	0.002	0.0015	0.002	0.002	0.006
Albuminoid ammonia	0.006	0.007	0.0030	0.005	0.0030	0.004	0.004	0.016
Nitrates	none	none	none	none	none	none	none	trace
Nitrites	none	none	none	none	none	none	none	none

Bacterial Examination; Germs Developed on a Gelatine Plate Inoculated with One Drop of Water.

After 24 hours	none	10	none	2,900	1,500	6,000	8,000	20
" 48 "	40	50	6,400	liq.	liq.	liq.	liq.	100
" 72 "	liquefied	liq.	liq.	liq.	liq.	liq.	liq.	300

Inoculation Experiments.

White rats were inoculated with 1 cu. cm. of beef tea culture, made from one drop of the water and one drachm of the tea, injected into the abdominal cavity, with the following results for each sample: Nos. 1, 4 and 5, death; Nos. 2, 6 and 7, the rats all sickened, but recovered; Nos. 3 and 8, negative.

Microscopical Examinations of Deposit, Magnified 100 Diameters, from 6 oz. of Water Placed in a Conical Glass.

Sample No. 1, bacteria, infusoria and plant detritus; Nos. 2 and 3, infusoria and unicellular plants; Nos. 4, 5, 6 and 7, desmids, bacteria, plant detritus and inorganic deposits.

Conclusions.

No. 1. The bacillus venenos brevis (found in this sample) I regard as a variety of the typhoid germ. The use of this water should be discontinued.

No. 2. Having isolated the poisonous germ from No. 1, it was not thought necessary to try further to find it in this. Of course, failure to find the germ does not positively prove its absence.

No. 3. There is no proof that this ice can cause disease. However, the large number of non-pathogenic germs in it renders it undesirable, and it should not be placed in milk or other drinks when used to cool them next summer.

Nos. 4, 5, 6 and 7. The Red Lake River water is not safe in its present condition, and the Red River water is questionable. Either should be purified before being used.

No. 8. In its present condition this water cannot cause disease.

causes typhoid fever. Professor Bolley, mentioned below, with poorer facilities for bacterial work, arrived at the same conclusion.

As is shown by the above record of typhoid cases and deaths, the epidemic reached its height in January, 1894. About this time samples of the Red Lake River water were sent to Prof. V. C. Vaughan, Director of the Michigan State Laboratory of Hygiene, at Ann Arbor, for chemical and biological analyses, and to chemists and biologists of the State University at Grand Forks, and the Agricultural College at Fargo, N. Dak., for the same purpose. All agreed in pronouncing the water unfit for use.

The first analyses made by Professor Vaughan have been supplemented by others, both of water and ice, including water from the Red River. Copies of these analyses have been furnished us by Professor Vaughan, and are presented in an abbreviated form in the accompanying table.*

The first two of these analyses condemned the water which was being furnished to the city on the dates named. The third analysis, of ice from the Red River, coupled with the first two water analyses, may have been the ground upon which the State Board of Health of North Dakota issued an order on June 1, 1894, prohibiting the sale of ice cut the previous winter from the Red Lake River, below Crookston, and the Red River of the North, below the Grand Forks College sewer. Analyses 4, 5, 6 and 7, made in July, 1894, were secured just about the time the city decided to build a filter. The last analysis, classed merely as "hydrant" water, was made after the filter had been in operation about a month, and presumably is filtered water.

During the summer of 1894 the city of Grand Forks decided to build a filter plant in accordance with the Lawrence experiments and similar to the one built by the city of Lawrence. When a popular vote was taken on issuing bonds to the amount of $40,000 for this purpose, only 26 negative ballots were cast, sad experience having taught the people the cost of an impure water supply.

The construction of the plant was started on Aug. 22, 1894, and water was first turned into the filter on Jan. 4, 1895. A plan and longitudinal section are shown by Figs. 37 and 38. The plant is located across the street from the pumping station, and includes a settling basin with a capacity of 147,000 gallons, 18,300 sq. ft. of filtering area and a 1,000,000-gallon clear water reservoir, all roofed over.

The excavation was in clay. The walls are all of hard brick, laid in hydraulic cement mortar, and the bottom and slopes are covered with the same material. The dimensions and general details of the plant are shown by Figs. 37 and 38. The roof is sheathed with 2-in. surfaced and matched plank, and the latter is covered with four thicknesses of one-ply tarred roofing-felt, pitch and gravel. The brick walls are carried up to the roof.

Fig. 39 is a partial cross-section of the covered filter bed in detail, and shows the way the filtering material is placed. The surface of the beds is a succession of ridges and hollows, as at Lawrence and Mount Vernon, only they are curved here. Unlike these two plants, but like the small one at Ilion, N. Y.,** though not in detail, the Grand Forks filter has a watertight bottom. The bottom at Ilion is of concrete, and that at Grand Forks is of brick, the collecting drains in each case being covered with loose brick, laid flat.

The character of the material in the bed is described by Mr. Russell as follows, after which follows some further information regarding the plant:

> We have neither stone, sand nor gravel in the immediate vicinity, except in the river, where we get sand for ordinary mason work. The sand and gravel used in the construction of the filter were hauled 45 miles by rail and about ¼ mile from the railroad to the filter by teams. All of the gravel and nearly all of the sand had to be screened. The most of it was frozen hard and had to be pounded up, all of it being placed after Dec. 15.
>
> Three separations were made of the gravel, which was placed as shown in section, Fig. 39, and the sand was placed in layers from 4 to 6 ins., to a depth of 5 ft., and thoroughly raked, to make sure that all the frozen lumps were pulverized. The sand was quite uniform in size of grain when taken from the pit, except a slight mixture of gravel, which was removed by screening.
>
> A test of the uniformity was made of each car by the use of a tin cup, 3 ins. in diameter and 12 ins. in depth, having a fine wire-screen bottom. This was filled to a depth of 8 ins. with sand, and then a certain amount of water turned in and the time of its disappearance noted, similar to the method used at Mount Vernon, N. Y., as described in Engineering News of Aug. 23, 1894.
>
> The accompanying diagram, Fig. 40, shows the sizes of the grains of the sand used. The surface of the

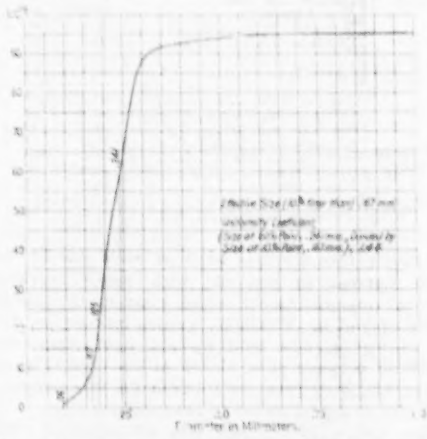


Fig. 40 Diagram Showing Size of Filtering Material at Grand Forks, in Accordance with the Lawrence Standard.

> sand is built up in small ridges over the under-drains to promote the expulsion of the air when the water is applied.
>
> At the time the water was first applied the weather was extremely cold. The temperature in the conduit and the underdrains beneath the sand was 33° F.; that of the sand was 20°, the atmosphere above the sand was 18°, and water was applied at 33°. The water was first applied through the underdrains, settling the sand from the bottom, and required three hours' pumping to raise the water above the surface.
>
> Our analysis shows a 50% reduction of free ammonia and a 72% to 77° reduction of the albuminoid ammonia, and almost total absence of bacteria. There has not been a case of typhoid fever in the city since the filtered water was turned into the city main about Jan. 1. (The letter from which this is taken was written March 26, 1895.—Ed.)
>
> The total cost of the plant, including the various pipe connections with the pumping station, outside drains, etc., exclusive of the property, is about $32,000, and the property upon which it is built cost $8,000.

In considering the cost of the plant, given above, it must be borne in mind that the $40,000 includes land for and the construction of a 1,000,000-gallon clear water reservoir, a roof for this, the filter and the setting basin, watertight bottoms and slopes for these, and pipe connections with the pumping station. Covering a filter increases its duty in a cold climate, and the money expended for this purpose in a locality where the thermometer goes as low as at Grand Forks is well invested.

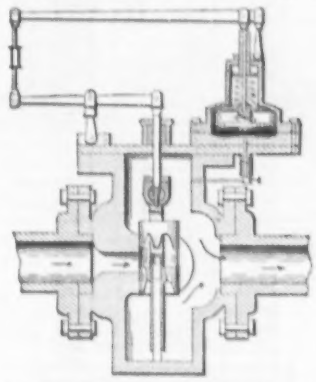
Grand Forks did well in constructing the filter plant described above. Besides being the third city in the country to put in a model sand filtration plant, it is the first one west of New York state to take this step, which makes it a pioneer in a double sense.

* The reports made at the time of the epidemic by Professor Vaughan, and by Professors E. F. Ladd and H. L. Bolley, of Fargo, are given in full in the report of the Board of Health of North Dakota for the two years, 1893 and 1894, in which will be found an account of this epidemic. The reports of the last-named professors were made to Dr. F. H. De Vaux, Superintendent of the Board of Health, while that of Professor Vaughan was made to Mr. H. L. Whitehed, Mayor of Grand Forks.

** See Eng. News, June 7, 1894.

THE ACTON WATER-WORKS REDUCING VALVE.

There are many instances in water supply systems where it becomes necessary or desirable to reduce the pressure in certain parts of the system, as, for instance, where the head of water from a mountain reservoir would bring a dangerous pressure upon the mains, or where it is desired to reduce the pressure in the distributing system from a direct high-pressure service to any required pressure. We illustrate this week the Acton patent water-works reducing valve, designed for this purpose, and which is a modification of the well-known Acton steam reducing valve. It consists of a double-beat piston valve operated by a diaphragm to which it is connected by multiplying levers. The cut is defective in that it does not show the valve seats, but the curved line on the right of the valve represents the outline of the shell carrying the seats. Water enters from the high-pressure pipe at the left of the cut and flows through the valve chamber to the low-pressure pipe on the right, and also enters the lower part of the diaphragm chamber by the small



The Acton Water-Works Reducing Valve.

branch pipe shown. The diaphragm is of watch-spring steel, and is very sensitive and very durable. Should the pressure on the low-pressure side of the valve exceed the desired limit (which can be regulated by the spring over the diaphragm), the diaphragm will force up the vertical stem, and thus move the piston valve down. Should the pressure be reduced too much, the spring will force the diaphragm and stem down, thus raising the piston valve and increasing the inlet area. The multiplying levers admit of a very close adjustment of the valve. These valves are in very extensive use, and the largest size yet made is 24 ins. diameter. Eight of these large valves are used at San Diego, Cal., to reduce the pressure from 135 lbs. to 40 lbs. per sq. in., and four at Los Angeles, Cal., reducing the pressure from 100 lbs. to 40 lbs. per sq. in. The valve is manufactured and sold by John Acton, 79 Washington St., Brooklyn, N. Y. The Western agent is the Chicago Engineers' Supply Co., of 167 Lake St., Chicago, Ill.

SUBMERGED WOODEN WATER-WORKS INTAKE PIPE, NEW WHATCOM, WASH. COM, WASH.

By C. M. Adams.

In 1894, while the writer held the office of City Engineer of New Whatcom, an extension was made to the intake of the city water-works. The city was very short of funds, and it was deemed necessary that as much money as possible should be retained within the community. For this reason a pipe was constructed of the native material, Douglass fir. The problem of submerging a wooden pipe for intake purposes, however, was a new one to the writer. After looking through all the libraries here, and consulting with all the engineers in the vicinity, he could find no precedent for the work, and was therefore thrown upon his own resources. He succeeded, nevertheless, in getting a good piece of work done at small cost. The following description of the work has been hurriedly prepared at the suggestion of a brother engineer. Perhaps it will some time help out another man in a similar scrape:

The city of New Whatcom, situated on the shores of Bellingham Bay, in the northwestern portion of the state of Washington, receives its supply of water by gravity from Lake Whatcom, a beautiful body of water 12 miles long, one mile wide, 316 ft. above mean low tide and only three miles distant from the city. About five years ago a local company constructed a water supply system, taking the water from this lake through steel pipes. The main, as it left the lake, was located for one-half mile along the banks of Whatcom Creek. That portion was destroyed by high water a few months later.

From that time until last fall the supply has been taken from the creek.

In the fall of 1893 the city purchased the plant, and in the following spring the council determined to replace 6,500 ft. of 20-in. steel pipe, which was leaking badly, with a larger and more permanent pipe, which was also to be extended into deep water in the lake, making a total distance of 9,000

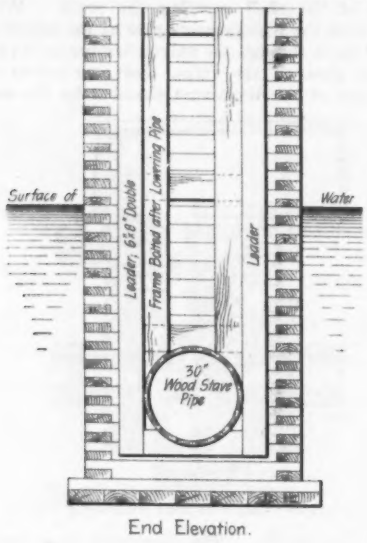


Fig. 1. Gate and Screen Chamber for Wooden Intake; New Whatcom, Wash

ft. The topography of the country is quite broken, necessitating several deep cuts and one 500-ft. tunnel. The money available to complete this work was but a trifle over $20,000, which necessitated the utmost possible economy. After careful consideration it was decided to use wooden stave pipe, and a call was made for bids for building 5,500 ft. of 24 and 3,500 ft. of 30-in. pipe, the staves of which were to be of Douglass fir. The lowest bid and the one accepted was by Jones & Miller, who represented Mr. D. C. Henny, Engineer for the Excelsior Wooden Stave Pipe Co., of San Francisco. The design selected was the Allen patent, which has been used extensively in Denver and other cities in recent years and has been thoroughly described in the Engineering News. The specifications were very exacting, as regards both material and construction, and were strictly complied with by the contractors.

The maximum curvature, 140 ft. radius, was successfully made with a 30-in. pipe. Only a few small leaks were found in the entire distance, which were quickly and easily stopped by wooden wedges. The novel feature of the work came in lowering the 30-in. wooden intake pipe, and in constructing the gate chamber, which is also built entirely of wood. The gate-chamber was built of 6 × 8-in. timbers, as shown by Fig. 1. A small wing-dam

WEATHER TABLE FOR APRIL, 1895, (Furnished to Engineering News by the Department of Agriculture.)

	Stations.	Temperature. (Deg. Fahr.) Average.	Max.	Min.	Range.	Wind. Velocity in miles per hour. Average.	Max.	Direction at time of max. velocity.	Precipitation—rain or melted snow—inches. Total.	Heaviest in 24 hours.	No. of rainy days.
Northern Cities.	Northfield, Vt.	40.2	71	16	55	8.9	40	NW	4.60	2.15	10
	Portland, Me.	42.5	63	23	40	8.6	44	S	5.95	2.85	12
	New York, N. Y.	47.7	82	30	52	14.5	54	NW	2.92	0.92	12
	Pittsburg, Pa.	53.6	82	28	54	7.0	31	SE	1.83	0.66	10
	Chicago, Ill.	46.3	81	29	52	18.3	40	E	0.86	0.38	7
	Omaha, Neb.	48.0	86	30	56	9.4	38	N	3.56	1.85	9
	St. Paul, Minn.	52.3	76	28	48	7.8	33	W	2.09	1.14	7
	Duluth, Minn	41 8	65	24	41	11.7	54	NW	0.73	0.38	5
	Bismarck, N. Dak	50.2	84	21	63	11.2	39	S	2.53	1.06	9
	Average	48.1	77	25	51	10.8	41		2.79	1.27	9
Southern Cities	Washington, D. C.	53.8	86	33	53	8.7	28	NW	6.26	1.98	13
	Louisville, Ky.	58.1	85	34	51	8.8	35	SE	3.10	1.08	10
	St. Louis, Mo	59.8	89	35	54	11.6	48	S	0.46	0.14	10
	Savannah, Ga	64.6	83	43	40	9.6	37	NW	4.43	1.27	12
	Kansas City, Mo	59.6	85	33	52	9.6	37	N	1.19	0.62	8
	Jacksonville, Fla.	67.2	85	45	40	8.5	31	S	4.40	1.10	13
	Chattanooga, Tenn.	60.0	82	33	49	7.9	40	S	3.64	1.89	11
	New Orleans, La.	67.8	87	50	37	8.8	28	NW	2.58	1.31	6
	Memphis, Tenn.	63.8	88	38	50	7.6	33	SE	2.32	1.30	7
	Palestine, Tex.	66 0	87	37	50	7.8	29	S	2.35	0.78	7
	Average	62.1	86	38	48	8.9	34		3.07	1.15	10
Western Cities.	Helena, Mont.	47.4	75	24	51	8.6	36	SW	0.53	0.36	4
	Port Angeles, Wash	45.5	62	30	32	5.4	25	W	1.77	0.80	12
	San Francisco, Cal	54.8	73	44	29	10.7	35	W	1.24	0.78	6
	Salt Lake City, Utah	51.2	79	23	56	7.8	38	W	0.73	0.44	6
	Santa Fe, N. Mex	49.0	70	18	52	8.5	38	SW	0.01	0.01	1
	Denver, Colo.	49.8	76	22	54	8.5	37	NW	1.19	1.07	7
	Yuma, Ariz.	70.2	98	45	53	7.3	46	NW	0.00	0.00	0
	Average	52.6	76	29	47	8.1	36		0.78	0.49	5

of rubble masonry was built on each side of the gate chamber to prevent high water breaking through into the tunnel, which commenced immediately back of it. The 30-in. wooden intake pipe, 420 ft. in length, was built upon a light temporary platform between piles, shown in the view, Fig. 2, which had been previously driven for this purpose, and also to act as guides in lowering the pipe.

The sinking of the pipe was accomplished very neatly and successfully by means of seven wooden cribs, 8 × 8⅓ ft. over all, loaded with rock and attached to the pipe. This was achieved as follows: Seven cribs, such as are shown in detail in Fig. 3, and six of which are shown in the view, Fig. 2, of a height to conform to the depth of water at the different points where they were to be placed, were built upon a barge, and, when nearly completed, were floated out to place and forced under the pipe, after which the three 6 × 8-in. cross timbers were bolted on, thus tightly securing the pipe. A rope was then passed underneath the pipe at each crib, one end of which was fastened to and the other end wound around a cap bolted on top of the piles above and across the pipe, after which the crib was partially filled with rock. When sufficient rock had been placed in the crib to overcome the buoyancy of the wood, the ropes were loosened and the pipe allowed to settle slowly until entirely under water. The filling of the cribs was then completed, after which the ropes were again loosened and the pipe lowered into place

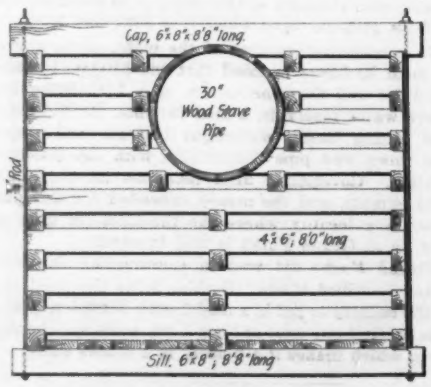


Fig. 2. Submerged Wooden Intake Ready for Sinking, at New Whatcom, Wash.

gradually and uniformly. The entire work of filling the cribs and lowering the pipe was accomplished in less than five hours, and without the least trouble from any cause, although great care was necessary to avoid overloading the ropes, for, had one broken, the pipe would have been practically ruined. The outer end of the pipe is in a depth of 20 ft. of water. The total cost of this intake, in place, including 420 ft. of pipe, piling, lumber, spikes, bolts and labor, was a little less than $1,000.

The staves used in all this pipe were made from 2 × 6-in. fir, dressed on all sides to conform to the circle, leaving them 1½ ins. in thickness when finished and were banded by ½-in. round steel rods, 12 ins. apart on the average. The contract

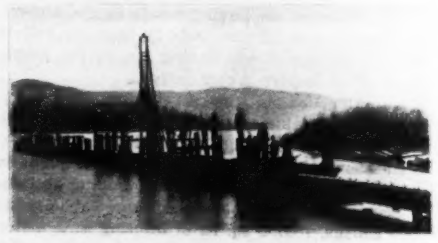


Fig 3 End View of Cribs for Sinking Wooden Intake at New Whatcom, Wash.

price for the 24-in. pipe was $1.11, and for the 30-in., $1.21 per lin. ft. Finished lumber for staves cost $14 per M.; rough lumber, $7 per M., delivered, and labor $2 per day. This pipe has been in use since November, 1894, during which time it has given perfect satisfaction in every particular.

SERVICE OF CABLES ON THE BROOKLYN BRIDGE RAILWAY.

During the 12 years since the opening of the Brooklyn Bridge, seven cables have been used on the cable railway, and the eighth cable is now in use. The seventh cable was removed on May 12, and we are indebted to Mr. G. Leverich, M. Am. Soc. C. E., Mechanical Engineer of the bridge, for the following table showing the service of each cable, by which it will be seen that No. 7 gave a longer service than any of the others:

Cable No.	Term of service, days.	Total distance hauled, miles.	Total passengers hauled.	Total ton-miles hauled.	Average loads hauled, tons.	Av. ratio live to dead load.
1.	1,140	223,329	49,062,442	22,142,706	97.0	6.0
2.	607	120,232	47,840,262	25,492,892	212.0	7.3
3.	393	82,099	36,941,884	20,395,073	248.4	7.6
4.	356	74,111	34,134,409	18,923,469	255.3	7.6
5.	520	111,116	56,287,452	33,857,669	304.7	8.3
6.	509	109,475	58,071,052	35,149,894	321.1	8.4
7.	511	111,136	59,815,950	35,932,894	323.3	8.3
8.	Now in use.					

The following approximate rule for obtaining the friction head in water-pipes is given by Prof. Merivale, of Newcastle-on-Tyne: $H = 1.4\ G^2h \div (3d)^5$. In this G is the flow in U. S. gallons per minute; h is the length of the pipe in yards; d is the diameter of the pipe in inches, and H is the head in feet due to friction.

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PERSONALS.

Mr. A. M. Wellington, one of the chief editors of Engineering News since 1887, died in New York city May 16, aged 47 years. A full account of his life and work will be found on our editorial page.

Mr. William Gifford has been elected City Surveyor of Schenectady, N. Y.

Mr. Henry Kanmier has been appointed Superintendent of Public Works at Port Huron, Mich.

Mr. E. C. Dunn was elected City Engineer of Alexandria, Va., by the City Council on May 14, 1895.

Mr. Charles K. Moore has resigned his position as Deputy Commissioner of Street Cleaning, of New York city.

Mr. Amos R. Barrett, formerly Superintendent of Motive Power of the Boston & Maine R. R., died at Somerville, Mass., May 11, at the age of 61.

Mr. W. H. V. Reimer has been appointed by the Township Committee of East Orange, N. J., as engineer in charge of the Prospect Valley drainage work.

Mr. Walter A. Thatcher has been appointed Chief Engineer of the Blue Mountain Ry. Co., of Philadelphia, Pa., which proposes to build a line from Harrisburg to Hamburg.

Mr. David L. Barnes, M. Am. Soc. M. E., delivered a lecture at Sibley College, Cornell University, Ithaca, N. Y., May 10, on "The Development of the Compound Locomotive in the United States."

Mr. J. Lowrie Bell, present Traffic Manager of the Central R. R. of New Jersey, and formerly of the Philadelphia & Reading R. R., will probably be made First Vice-President of the first-named company.

Mr. W. F. Pascoe, of Easton, Pa., has resigned his position as President of the South Easton Water Co., and will go to Waltham, Mass., to take charge of a contract for the Standard Construction Co., of Easton.

Mr. Frank H. Eno has been elected Village Engineer of Winnetka, Ill. He has been for several years associated with Mr. John A. Cole, and was Assistant Engineer of the Water Supply and Sewerage Department of the Columbian Exposition.

Mr. John W. Cowper has been appointed Supervisor of Track on the Cairo Division of the Cleveland, Cincinnati, Chicago & St. Louis Ry., from Mt. Carmel to Danville, with headquarters at Mt. Carmel, Ill., vice Mr. F. S. Balcom, resigned.

Mr. I. O. Walker has been appointed Engineer of Maintenance of Way, and has entire charge of maintenance of way and structures over all lines of the Paducah, Tennessee & Alabama R. R. and the Tennessee Midland Ry., with offices at Paducah, Ky.

Mr. Oliver H. P. Cornell has been appointed Chief Engineer of the Chesapeake & Western R. R. Co. and the Old Dominion Construction Co., which companies are about to build a railway in Virginia and West Virginia. The New York offices are at No. 1 Broadway.

Mr. Louis A. Risse has been appointed Chief Engineer of Construction, and Mr. Josiah A. Briggs, M. Am. Soc. C. E., Chief Engineer of the Concourse, in the Engineering Bureau of the Department of Street Improvements for the 23d and 24th Wards, New York city.

Mr. H. N. Ogden has been appointed by the Board of Sewer Commissioners of Ithaca, N. Y., as Engineer and Superintendent of Construction of the newerage and drainage works about to be commenced. Mr. Rudolph Hering, M. Am. Soc. C. E., has been appointed Consulting Engineer.

Mr. John C. Trautwine, Jr., late President of the Engineers' Club of Philadelphia, and owner and editor of Trautwine's "Engineer's Pocket-Book," has been appointed Chief of the Water Bureau of Philadelphia. He was the successful candidate in the late Civil Service examination for that position, noted in this journal.

Gen. O. M. Poe and Maj. E. H. Ruffner, Corps of Engineers, U. S. A., have been appointed by the Secretary of War to investigate and report upon the probable effect of the flow of the Chicago Drainage Canal upon the lake levels. The shipping interests on the lakes are closely connected with the maintenance of the present lake level, and the report of this commission will doubtless set at rest the many vague rumors now afloat as to the ultimate injurious effect of the drainage canal upon these interests.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

INDIANAPOLIS ENGINEERING CLUB.
May 25. Secy., C. C. Brown, City Engineer.
AMERICAN WATER-WORKS ASSOCIATION.
May 28 to 31. Annual meeting at Atlanta, Ga. Secy., Peter Milne, New York, N. Y.
WISCONSIN POLYTECHNIC SOCIETY.
May 28. Secy., W. K. Means, Loan & Trust Building, Milwaukee.
ENGINEERING CLUB OF COLUMBUS, O.
June 1. Secy., David Buell.
ENGINEERS' CLUB OF PHILADELPHIA.
June 1. Secy., L. F. Rondinella, 1122 Girard St.
ENGINEERING SOCIETY OF WESTERN NEW YORK.
June 3. Secy., Geo. R. Sikes, 122 Pearl St., Buffalo, N. Y.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
June 5. Discussion on "The Santa Ana Irrigation Canal." Annual meeting at Nantasket, Mass., June 18. Secy., C. W. Hunt, 127 E. 23d St., N. Y. city.
ENGINEERS' CLUB OF ST. LOUIS.
June 5. "Water Towers at Laredo, Tex., and St. Charles, Mo.," by Edward Flad. Secy., W. H. Bryan, Turner Block.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
June 7. Secy., O. H. Von Geldern, 819 Market St., San Francisco.
MONTANA SOCIETY OF CIVIL ENGINEERS.
June 8. Secy., Forrest J. Smith, Denver Block, Helena, Mont.
ENGINEERS' CLUB OF KANSAS CITY.
June 10. Secy., F. W. Tuttle, Baird Building.
MASTER CAR BUILDERS' ASSOCIATION
June 11. Annual Convention at Alexandria Bay, N. Y. Secy., J. W. Cloud, Rookery Building, Chicago, Ill.
NORTHWESTERN SOCIETY OF ENGINEERS.
June 11. Secy., D. W. McMorris, Burke Building, Seattle, Wash.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
June 11. Secy., F. A. Coburn, Case Library Building.
DENVER SOCIETY OF CIVIL ENGINEERS.
June 11. Secy., H. Breen, 36 Jacobson Block.
ASSOCIATION OF RAILWAY TELEGRAPH SUPTS.
June 12. Montreal, Que. Secy., P. W. Drew, Wisconsin Central Ry., Milwaukee, Wis.
ENGINEERS AND ARCHITECTS' CLUB OF LOUISVILLE.
June 13. Secy., Jas. K. Zollinger, Norton uilding.
ENGINEERING ASSOCIATION OF THE SOUTH.
June 13. Secy., H. D. Ruhm, Nashville, Tenn.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
June 14. Secy., D. W. Meeker, St. Paul, Minn.
AMERICAN RAILWAY MASTER MECHANICS' ASSOC'N.
June 17. Annual Convention at Alexandria Bay, N. Y. Secy., Angus Sinclair, 256 Broadway, New York city.
ENGINEERS' CLUB OF MINNEAPOLIS.
June 17. Secy., E. Nexson, Kasota Block.
COLUMBIAN ENGINEERING SOCIETY.
June 18. Secy., W. F. Hart, University Building, 15th and H Sts. N. W., Washington, D. C.
ENGINEERS AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
June 19. Secy., F. Van Vleck, Los Angeles, Cal.
WESTERN SOCIETY OF ENGINEERS.
June 19. Secy., Chas. J. Roney, 1736 Monadnock Block, Chicago.
BOSTON SOCIETY OF CIVIL ENGINEERS.
June 19. Secy., S. E. Tinkham, City Hall, Rooms 36 Bromfield St.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
June 20. Secy., D. Carhart, Carnegie, Library Building, Allegheny.
ENGINEERS' CLUB OF CINCINNATI.
June 20. Secy., J. F. Wilson, Odd Fellows' Temple.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
June 25-28. Annual Convention at Detroit, Mich., F. R. Hutton, Secy., 12 W. 31st St., New York city.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—At the meeting on May 15 a paper on the "Water-Works of Syracuse, N. Y.," was read by Mr. W. R. Hill. These works, which were fully described and illustrated in our issue of Dec. 13, 1894, comprised a steel intake pipe from Skaneateles Lake, a dam at the foot of the lake, a conduit line of 30-in. cast iron pipe, and a new distributing reservoir.

Mr. E. S. Gould thought that the shallow puddle core wall of the reservoir embankment should have been carried considerably higher, the 6-in. concrete facing and 12-in. stone paving not being impermeable. Puddle may be more impermeable than masonry, but if once water gets into a puddle core wall it will gradually destroy it, and the most scrupulous and minute care is necessary to insure a good puddle wall. For this reason the smaller and less important dams of this type are specially liable to failure. The late Mr. W. J. McAlpine emphasized this need for rigid attention to every detail of construction of earth dams (Eng. News, Nov. 17, 1888).

Mr. J. J. R. Croes referred to the long and careful examination of the various available sources of additional supply, and to the close approximation of the preliminary estimates and the actual cost of the work. He did not believe a masonry core wall to be at all essential, a good puddle wall being equally good, as proved by actual experience with many dams of this construction.

Mr. J. N. Green suggested a masonry core wall faced with puddle, and stated that Mr. McAlpine advocated ordinary puddling of the entire upstream part of the dam. A common mistake is to carry up the core wall and the careful work only as far as the high-water line, and then to fill in the top portion somewhat like a railway embankment. Then when a wave or a sudden flood raises the water level above the estimated high-water line, the dam should be breached.

Mr. J. M. Goodell stated that at dam No. 6 of the Boston Water-Works, wells have been sunk along the face of the core wall, and water has been found at a level 1 ft. below that of the water in the reservoir. The dam was very carefully constructed, and was only completed about a year ago. Mr. Croes thought that the water in the test wells was forced up from below and did not penetrate horizontally through the dam.

CIVIL ENGINEERS' CLUB OF CLEVELAND.—At the meeting on May 14 Dr. Dayton C. Miller delivered a lecture on "Polarized Light," illustrated by the polariscope. F. A. Coburn, Secy.

ENGINEERS' CLUB OF ST. LOUIS.—At the meeting on May 15, Mr. M. A. Howe, Professor of Civil Engineering at the Rose Polytechnic Institute, Terre Haute, Ind., gave an address on "Recording Bridge Deflections." He described in detail a series of experiments made by himself and classes of students in 1892 and 1894. He was of the opinion that the vibrations were much less than had been heretofore assumed. In several cases he had computed the deflections from approved formulae and had found the result considerably more than that actually observed. In the particular cases considered, he believed this due to the fact that the top and bottom chords were practically continuous girders, and therefore carried a large proportion of the strain.

William H. Bryan, Secy.

NEW PUBLICATIONS.

THE USE OF STEEL IN LARGE BUILDINGS.—By Corydon T. Purdy. 8vo; pp. 33; illustrated.

This is a paper read before the Boston Society of Civil Engineers in January, and is reprinted from the Journal of the Association of Engineering Societies. It deals with the general design and details of construction, and is illustrated with numerous examples of actual work.

STATE BOARD OF HEALTH OF COLORADO: Report for the Years 1892, 1893 and 1894. Henry Sewall, Denver, Colo., Secretary. 8vo; pp. 304; tables.

This report is the first one published by this Board for some 14 years, during which period but little was accomplished, until the present Board was appointed in 1892. A number of meteorological tables are given in the report.

STATE BOARD OF HEALTH OF NORTH DAKOTA: Report for the Years 1893 and 1894. F. H. De Vaux, Superintendent. 8vo; pp. 85.

This report contains an account of the typhoid epidemic at Grand Forks in 1893-4, which includes chemical and bacteriological analyses of water from the public water-works. This water contained typhoid germs, according to the belief of Prof. V. C. Vaughan, of the University of Michigan, who made careful bacterial examinations of it.

AROUND THE LAKES.—Detroit Dry Dock Co., Detroit, Mich. Oblong, 8vo; pp. 235; illustrated.

This is a handsome volume, containing a large amount of information relative to the ships and traffic of the great lakes, and having good half-tone engravings of a number of side-wheel and screw steamers for freight and passenger service, and of the big car-ferry or transfer steamers "St. Ignace" and "Ste. Marie." There are also views and particulars of the company's shops and shipyards, a description of the Howden hot draft system, and interesting accounts of the wreck and rebuilding of the "Philip D. Armour" and the raising of the sunken steamer "Kasota," 248 ft. long, by means of casks filled with compressed air.

TRADE PUBLICATIONS.

FEED WATER PURIFICATION.—We-Fu-Go Co., Cincinnati, O. Paper; 3½ × 6½ ins.; pp. 19.

This little pamphlet discusses the causes and effects of scale in boilers, heaters, etc., and states that the company's process turns the scale-forming impurities of the water into a soft, muddy mass, which can be washed out of the purifiers by a stream of cold water.

ELECTRIC DENTAL ENGINES.—Pieper Bros., San Jose, Cal. Paper; 6½ × 5 ins.; pp. 16; illustrated.

Various small and delicate appliances are shown, including a little motor enclosed in a spherical case and suspended from the ceiling, the motor being run by a 110-volt direct current, or a 4-volt storage battery, and making 800 to 4,000 revolutions per minute.

PIPE AND HYDRANTS.—Reading Foundry Co., Reading, Pa. Paper; 8vo; pp. 43; illustrated.

This is an illustrated catalogue and price list of cast iron pipe, specials, valves, stop-boxes, hydrants, lamp-posts and other castings, together with gearing, pulleys and the Canada turbine, 12 to 60 ins. diameter. There are also handy tables of the thickness and

weight of pipe, prices per net and gross ton, and areas of circles, and rules for discharge of pipes, capacity of tanks, etc.

THE TRIDENT WATER METER.—Neptune Meter Co., 253 Broadway, New York city. 8vo; paper; pp. 52; numerous illustrations.

The Trident water meter, a positive meter of the disk type, is described and illustrated in this catalogue in a manner which cannot fail to attract and interest those who have to do with meters. A section of the pamphlet is devoted especially to simple and compound proportional meters for measuring the flow of large pipes. Mr. John Thomson, M. Am. Soc. C. E., is vice-president and engineer of the company.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
May 24.	Excavating at Newburg, N. Y.		May 2
May 24.	Asphalt paving,	Washington, D. C.	May 9
May 24.	Road improvements,	Glendale, R. I.	May 16
May 24.	Water tower, etc.,	West Troy, N. Y.	May 16
May 24.	Sewers,	Fonda, N. Y.	May 23
May 24.	Asphalt paving,	Utica, N. Y.	May 23
May 25.	Bridge substructure,	Cleveland, O.	May 9
May 25.	Water-works system,	Oak Park, Ill.	May 16
May 25.	Sewers,	Oak Park, Ill.	May 16
May 25.	Water bonds	Rockville Center, N. Y.	May 16
May 25.	Drawbridge,	Boston, Mass.	May 23
	Advertised, Eng. News, May 23.		
May 25.	Brick paving,	Sistersville, W. Va.	May 23
May 25.	Filling (5,000 cu. yds.),	Pittsburg, Pa.	May 23
May 25.	Fire station,	Melrose, Mass.	May 23
May 25.	Boilers,	Boston, Mass.	May 23
May 25.	Bridge masonry (7 contracts),	Pittsburg.	May 23
May 25.	Stone bridges (4 contracts),	Pittsburg.	May 23
May 25.	Cement (2,000 bbls.),	Pittsburg, Pa.	May 23
May 27.	Dams & shore protections,	Miss. River.	May 2
	Advertised, Eng. News, May 2 to 23.		
May 27.	Street improvements,	Evanston, O.	May 9
May 27.	Steel bridge,	Crawfordsville, Ind.	May 16
May 27.	Water-works system,	Peraskie, Pa.	May 16
	Advertised, Eng. News, May 16 and 23.		
May 27.	Sewer,	Plymouth, Ind.	May 16
May 27.	Hospital,	Binghamton, N. Y.	May 16
May 27.	Paving,	Philadelphia, Pa.	May 16
May 27.	Pumping station,	Russell, Kan.	May 16
May 27.	Pipe and brick sewers,	Syracuse, N. Y.	May 23
May 27.	Stone bridge,	Syracuse, N. Y.	May 23
May 27.	Asphalt paving,	Syracuse, N. Y.	May 23
May 27.	School buildings (2),	Providence, R. I.	May 23
May 27.	Electric wiring at	Philadelphia, Pa.	May 23
May 27.	Electric wiring at	Monroe, La.	May 23
May 27.	Repaving,	Allegheny, Pa.	May 23
May 27.	Improving court house,	Brooklyn, N. Y.	May 23
May 27.	Cement (400 bbls.),	S. Framingham, Mass.	May 23
May 27.	Sewer,	Lansdale, Pa.	May 23
May 27.	Water bonds ($2,500),	Lake City, Minn.	May 23
May 27.	Water main ext'ns,	Brenham, Tex.	May 23
May 28.	Jail,	Brazil, Ind.	Apr. 25
May 28.	Pier work,	New York, N. Y.	May 16
May 28.	Electric light bonds,	Wapakoneta, O.	May 16
May 28.	Pipe sewers,	Buffalo, N. Y.	May 16
May 28.	Public bldg. work at	St. Paul, Minn.	May 16
May 28.	Cobblestone paving,	Brooklyn, N. Y.	May 16
May 28.	School buildings (2),	Troy, N. Y.	May 23
May 28.	Brick paving,	Indianapolis, Ind.	May 23
May 28.	Stone paving (2,365 sq. yds.),	New York.	May 23
May 28.	Water supply for	Kearny, N. J.	May 23
May 28.	Trenching,	Ottawa, Ont.	May 23
May 28.	Levee (600,000 cu. yds.),	Memphis, Tenn.	May 23
May 28.	Iron bridge,	Almena, Kan.	May 23
May 28.	Garbage collection,	Gloversville, N. Y.	May 23
May 29.	Machine tools,	Watertown, Mass.	May 2
May 29.	Sewer,	Cleveland, O.	May 9
May 29.	Brick building,	Sherman, Tex.	May 9
May 29.	Dredging,	Tompkinsville, N. Y.	May 16
May 29.	College buildings,	St. Paul, Minn.	May 16
May 29.	Pmpg. eng. & boiler,	Buffalo, N. Y.	May 16
May 29.	Bldgs. for	Braddock Point Station, N. Y.	May 16
May 29.	Public bldg. work at	Newbern, N. C.	May 16
May 29.	Steel frame for bldg.,	Washington.	May 16
May 29.	Laying water pipe,	New Orleans, La.	May 23
May 29.	Granite block paving,	Boston, Mass.	May 23
May 29.	Manhole & catch basin covers,	Chicago.	May 23
May 29.	Telford pav'g (20,500 sq. yds.),	Cleveland	May 23
May 29.	Wells (8),	National Military Home, O.	May 23
May 29.	Compos'n hyd't & valve basins,	Chicago.	May 23
May 29.	Bridge superstructure,	Cleveland, O.	May 23
May 29.	Lumber for bridges (375 M. ft.),	Chicago.	May 23
May 30.	Steel tank, pump, etc.,	Wenona, Ill.	May 16
May 31.	Pipelaying (50 miles),	Syracuse, N. Y.	May 9
	Advertised, Eng. News, May 9 and 16.		
May 31.	Water-works system,	Whitehall, Wis.	May 9
May 31.	Pipe sewers (5,000 ft),	Findlay, O.	May 9
May 31.	Cement and sand,	Portland, Me.	May 16
	Advertised, Eng. News, May 16 and 23.		
May 31.	Artesian well,	Elmwood, Ill.	May 16
May 31.	School building,	Reading, Mass.	May 16
May 31.	Pipe sewers (17½ miles),	Ann Arbor.	May 16
	Advertised, Eng. News, May 16 and 23.		
May 31.	Cement sidewalks,	Avondale, O.	May 23
May 21.	Court house,	Wilkes Barre, Pa.	May 23
May 31.	Highway bonds ($400,000),	Boston, Mass.	May 23
May 31.	Bridges & mas'ry,	Washington C. H., O.	May 23
May 31.	Boiler,	Newark, N. J.	May 23
May 31.	Court house,	Nanaimo, B. C.	May 23
June 1.	Electric lighting,	Vancouver, B. C.	Apr. 25
June 1.	Plans for cotton factory,	Weldon, N. C.	May 9
June 1.	Steel forgings, etc.,	Washington, D. C.	May 16
June 1.	Steam road roller,	Toronto, Ont.	May 16
	Advertised, Eng. News, May 16 and 23.		
June 1.	Water-works system,	Postville, Ia.	May 16
June 1.	Brick paving,	Ashtabula, O.	May 16
June 1.	Concrete sidewalks,	Dolgeville, N. Y.	May 16
	Advertised, Eng. News, May 16 and 23.		
June 1.	Grading,	Kansas City, Mo.	May 16
June 1.	Cement sidewalks,	Indianapolis, Ind.	May 23
June 1.	Asylum annex,	Goldsboro, N. C.	May 23
June 1.	Railway shops at	Wabash, Ind.	May 23
June 1.	Water bonds ($75,000),	Meadville, Pa.	May 23
June 1.	Fence (6,000 ft.),	Salt Lake City.	May 23
June 3.	Courthouse plans,	Winfield, W. Va.	Apr. 18
June 3.	Electric lighting,	Chattanooga, Tenn.	May 16
June 3.	Water bonds	College Point, N. Y.	May 16
June 3.	Powder for	Benicia Arsenal, Cal.	May 16
June 3.	Building,	Nebraska City, Neb.	May 16
June 3.	Court house,	Natchitoches, La.	May 16
June 3.	Pipe, valves, etc.,	Allegheny, Pa.	May 23
June 3.	Sewers,	Auburn, N. Y.	May 23
	Advertised, Eng. News, May 23 and 30.		
June 3.	Sewers,	College Point, N. Y.	May 23
June 3.	Sewers,	Washington, D. C.	May 23
June 3.	Electric lighting,	Asbury Park, N. J.	May 23
June 3.	Electric lighting,	Washington, D. C.	May 23
	Advertised, Eng. News, May 23.		
June 3.	Sewer bonds ($100,000),	Brooklyn, N. Y.	May 23
June 3.	Road improvements,	Athens, O.	May 23
June 4.	Right to cut timber,	Toronto, Ont.	May 9
June 4.	Cast iron pipe,	Toledo, O.	May 16
June 4.	Officers' barracks,	Omaha, Neb.	May 16
June 4.	Court house,	Zebulon, Ga.	May 16
June 4.	Grading, etc.,	Columbus, O.	May 23
June 4.	Grading,	New York, N. Y.	May 23
June 4.	Sewers,	Brooklyn, N. Y.	May 23
June 4.	Sewers,	New York, N. Y.	May 23
June 4.	Pipe sewers,	Buffalo, N. Y.	May 23
June 4.	Sewer,	Flushing, N. Y.	May 23
June 4.	Water-works system,	Juneau, Wis.	May 23
June 4.	Iron bridge,	Boonton, N. J.	May 23
	Advertised, Eng. News, May 23.		
June 4.	Water tunnel work,	Buffalo, N. Y.	May 23
June 5.	Bridges,	Cottonwood Falls, Kan.	May 9
June 6.	Foundation for lock,	New Orleans, La.	May 16
June 6.	Granite block paving,	Cincinnati, O.	May 16
June 6.	Public bld'g approaches at	Scranton, Pa.	May 23
June 6.	Tube well plant,	Lowell, Mass.	May 23
	Advertised, Eng. News, May 23 and 30.		
June 6.	Resetting boilers,	Yonkers, N. Y.	May 23
June 6.	Smoke-preventing device,	Rockford, Ill.	May 23
	Advertised, Eng. News, May 23.		
June 6.	Bridges,	Indianapolis, Ind.	May 23
June 7.	Bridge,	Versailles, Ind.	Apr. 18
June 7.	Piers, etc.,	Detroit, Mich.	May 9
	Advertised, Eng. News, May 9 to 30.		
June 7.	Pipelaying,	Syracuse, N. Y.	May 16
	Advertised, Eng. News, May 16 and 23.		
June 7.	State house,	Providence, R. I.	May 16
June 7.	Public building,	Rock Island, Ill.	May 16
June 8.	Water-works franchise,	Alexandria, Ind.	May 16
	Advertised, Eng. News, May 16 and 23.		
June 9.	Public bldg. work at	Taunton, Mass.	May 16
June 10.	Electric light plant,	Montreal Que.	May 9
June 10.	Building,	Faribault, Minn.	May 16
June 10.	Observatory,	Columbus, O.	May 16
June 10.	Interior of court house,	Rochester, N. Y.	May 16
June 10.	Armory work,	New York, N. Y.	May 23
June 10.	Water-works system,	Forestville, N. Y.	May 23
	Advertised, Eng. News, May 23 and 30.		
June 11.	Brick paving (15,000 sq. yds.),	Ithaca.	May 23
	Advertised, Eng. News, May 23 and 30.		
June 10.	Electric lighting,	Lansingburg, N. Y.	May 23
June 10.	Paving bonds,	Omaha, Neb.	May 23
June 10.	Street railway franchise,	Sacramento.	May 23
June 10.	Railway 9½ miles),	Rumford Falls, Me.	May 23
	Advertised, Eng. News, May 23 to June 6.		
June 10.	Water bonds ($8,000),	Norwood, Mass.	May 23
June 10.	Water-tube boilers (4),	Chicago.	May 23
June 10.	Earth dams,	North Adams, Mass.	May 23
	Advertised, Eng. News, May 23 and 30.		
June 12.	Public bld'g approaches at	Lewiston, Me.	May 23
June 13.	Wooden bridge,	Butte, Mont.	May 23
June 14.	Stone and brick work at	Richmond, Ky.	May 23
June 14.	Bridge,	Central City, Neb.	May 23
June 14.	Water-works system,	Montgomery, N. Y.	May 23
	Advertised, Eng. News, May 23 to June 6.		
June 15.	Irrigation canal,	Portland, Ore.	Apr. 18
June 15.	Sinking wells,	Norfolk, Va.	May 16
	Advertised, Eng. News, May 16.		
June 15.	Water bonds,	Canandaigua, N. Y.	May 16
June 15.	Street improvements,	Avondale, O.	May 23
June 15.	Sewer,	Emporium, Pa.	May 23
	Advertised, Eng. News, May 23.		
June 15.	Steel bridges (2 contracts),	London, Ont.	May 23
	Advertised, Eng. News, May 23 to June 6.		
June 17.	Building supplies,	Washington, D. C.	May 23
June 17.	Electric lighting,	Scottdale, Pa.	May 23
	Advertised, Eng. News, May 23 to June 13.		
June 17.	Viaduct (642 ft.),	Albany, N. Y.	May 23
June 19.	Water-works system,	Pawhuska, Okla.	May 16
June 19.	Bridge mas'ry, (5 cont's),	Norristown, Pa.	May 23
June 19.	Steel bridge,	Ironton, O.	May 23
June 20.	Electric light plant,	Athens, O.	May 23
June 20.	Bridge bonds ($20,000),	Dayton, O.	May 23
June 20.	Fence,	Columbus, O.	May 23
June 21.	Water-works system,	Elmwood, Ill.	May 23
	Advertised, Eng. News, May 23.		
June 26.	Court house and jail,	Swainsboro, Ga.	May 16
June 27.	Jetty work,	Montgomery, Ala.	May 16
	Advertised, Eng. News, May 16 to June 6.		
July 3.	Bridges,	Ukiah, Cal.	Apr. 18
July 6.	Jail cells,	Auburn, Cal.	May 16
July 8.	Courthouse,	Baltimore, Md.	May 9
	Advertised, Eng. News, May 9 to 23.		
Aug. 2.	Electric lighting,	El Paso, Tex.	May 23
Aug. 5.	Plans for state capitol,	St. Paul, Minn.	Apr. 25
Oct. 1.	Plans for art building,	Philadelphia, Pa.	May 23
	Advertised, Eng. News, May 23 to June 27.		
No date.	Artesian well,	Ennis, Tex.	May 23
"	Bridge work,	Dallas, Tex.	May 23

RAILWAYS.

BANGOR & PORTLAND.—Press reports state that a meeting of the Easton & Northern R. R. Co. will soon be held to vote on an increase in its capital stock from $200,000 to $300,000. The road, which is controlled by the Lehigh Valley, but which is leased to and operated by the Bangor & Portland, extends from Easton to Belfast, Pa., 8.04 miles. It is the intention to expend the new capital on an extension of the line to South Easton, to connect with the main line of the Lehigh Valley, as was originally contemplated.

BLUE MOUNTAIN.—This company, noted in our issue of May 9, has perfected a permanent organization preparatory to constructing its road, according to reports. The surveys and locations are said to have been completed. Pres., Wm. Thompson; Gen. Counsel, Wm. C. Mayne; Secy., J. F. Brinton; Ch. Engr., Walter A. Thatcher; Principal Office, 926 Walnut St., Philadelphia.

CHICAGO, INDIANA & EASTERN.—Fremont Wilson, Ch. Engr., Fairmount, Ind., writes us that this railway has been surveyed from Fairmount to Muncie, and the line between Fairmount and Matthews, 12 miles, was to be opened for traffic this week. Capital for constructing the entire 75 miles has been secured, and contracts will be let within 60 days for the part not now under contract. Pres., M. H. Alberger, Chicago.

KISH-WAU-KEE MINERAL SPRING.—Incorporated in Pennsylvania May 15 to build a steam railway from Big Shanty to Pierce Camp, a distance of five miles; capital stock, $50,000; Pres., Jas. Pierce, Boston, Mass.; J. R. Droney and B. M. Galley, of Bradford, Pa., are directors.

LANCASTER & HAMDEN.—A press report states that Col. Wm. H. Stevenson, formerly Supt. New York, New Haven & Hartford and Pres. Housatonic and other New England roads, has become connected with this railway, in Ohio, a coal road now being constructed between Columbus and Wellston, and is forming a syndicate to complete the road, which will furnish a valuable and greatly desired line for an outlet from the Jackson coal fields to the lakes, via roads leading north from Columbus. It is proposed to extend the line from Wellston or McArthur southward to a point on the Ohio River opposite Huntington, W. Va., or Ashland, Ky., having in view the reaching, via the Big Sandy Road, of the vast deposits of cannel and coking coals in Eastern Kentucky and West Virginia. It is expected that the line between Columbus and Wellston will be completed during the summer. J. G. Reeves, Lancaster, O., is president of the company, and J. C. Short, New York, receiver.

LEHIGH VALLEY.—Press reports state that this company has resolved to have terminal facilities of its own at Niagara Falls, N. Y., and has begun the work of building the track hence to Buffalo. Plans for the construction of the Buffalo, Thousand Islands & Portland R. R. have been laid out, and the construction was commenced May 16 by Barney Smith and F. J. Reap, contractors, of Rochester, with 100 men and 25 teams. The B., T. I. & P. was projected by the Rome, Watertown & Ogdensburg some five years ago, but the franchise fell into the hands of the Central and afterward the Lehigh.

MARLBORO & SUDBURY.—Reports from Marlboro, Mass., state as follows: A plan for a railway from this city to South Sudbury is being advocated here by H. A. Hancock, Louis Maynelle, William H. Ireland and D. W. Archibald. It is to be seven miles long, running through Marlboro and Sudbury territory, past the Wayside Inn and connecting with the Boston & Main (Central Massachusetts) and New York, New Haven & Hartford (Lowell & Framingham) at South Sudbury. It will, if constructed, bring this city seven miles nearer Boston than any existing route. Petitions to the railroad commissioners are being extensively signed.

RUMFORD FALLS & RANGELEY LAKES.—Bids are asked until June 10 for constructing a 9½-mile extension of this railway, from Byron to Bemis, Me., as stated in our advertising columns. R. B. Straton, Ch. Engr., Rumford Falls, Me.

Southern.

CHARLESTON, CLENDENIN & SUTTON.—D. Minotti, of Charleston, W. Va., is reported to have been awarded a contract for 14 miles of stone work on this road, from Syracuse, 36 miles from Charleston, to Clay C. H.

DYERSBURG & MISSISSIPPI RIVER.—J. M. Brackle, Pres., Dyersburg, Tenn., writes us that no surveys have yet been made or contracts awarded for this railway, which will be 18 miles in length. A committee is now at work considering means of construction, etc.

GLEN JEAN LOWER LOUP & DEEP WATER.—Incorporated in West Virginia May 10, with a capital stock of $500,000, commencing with $20,000; incorporators, J. W. Davis, Coffman, W. Va.; S. L. Price, Frankfort, W. Va.; J. A. Preston, and others, of Lewisburg, W. Va.

MONONGAHELA RIVER.—A press report from Fairmont, W. Va., states that at a meeting of the directors of this company in that city May 15 it was determined to build a railway from some point on the Monongahela River to connect with the Ohio River road in the vicinity of New Martinsville or Sistersville. The route will be either up Ten Mile Creek or Bingamon Creek. Col. J. A. Fickinger and E. R. Curtis, Engrs., will commence the survey at once, and are authorized to receive bids and let such portions of the work to contractors as soon as possible, with a view to the early completion of the road. The report states that this road is independent of the road talked of from near Clarksburg to New Martinsville. The eastern terminus will probably be near Monongah and Fairmont.

Northwest.

LOGGING ROAD.—Press reports from Mora, Minn., state that Stillwater capitalists are planning to build a logging railway from Mille Lacs Lake to Mora this summer. The road would probably become a branch of the Great Northern.

VALLEY TERMINAL.—The incorporation of this company was noted last week. The following officers have been elected: Pres., John J. MacIntyre, Niagara Falls, N. Y.; Vice-Pres., George E. Green, Binghamton, N. Y.; Secy., Walter B. Pelton, Appleton, Wis.; Treas., W. Joseph Taylor, Detroit; Attorney, Albe Lallen, Chicago. It is stated that contracts for rails and material will be let at once, and tracklaying is expected to begin July 1. The headquarters of the company will be at Appleton, Wis.

Southwest.

GULF & INTERSTATE.—The engineering corps of the Nebraska division of this road was camped at Virginia, Neb., last week.

TEXAS STATE.—L. W. Wells, Ch. Engr., Tyler, Tex., writes us that this railway is projected from Rusk to Palestine, Tex., 34 miles. The line has been surveyed and is being constructed by the convicts of the state, about seven miles being completed.

Rocky Mt. and Pacific.

COLUMBIA & RED MOUNTAIN.—E. J. Roberts, Ch. Engr., Spokane, Wash., writes us that this railway is projected as an extension of the Spokane Falls & Northern, from Northport, Wash, to Rossland, B. C., 15 miles, of which 7½ miles are in Canada. On the Canadian side the company is chartered as the Red Mountain Ry. Co. Surveys are in progress, and construction will soon follow. The line runs into the Trail Creek mining district.

RIO GRANDE BRANCH LINE.—E. T. Jeffery, Geo. Coppell and E. O. Wolcott, president, chairman of board and general council, respectively, of the Denver

& Rio Grande, have organized this company to build a line into the Trinidad coal fields, in Colorado.

WHITE RIVER VALLEY.—F. T. Lewis, Ch. Engr., Meeker, Colo., writes us that the road is projected from New Castle, Colo., to Meeker, 50 miles. Surveys are nearly completed, and it is expected that trains will be running by fall. The road will open up a large area of valuable coal lands and also penetrate a fine stock country. No rock or difficult work will be encountered. Pres., A. C. Drumm, Denver, Colo.

Foreign.

GUATEMALA.—The Pittsburg, Pa., "Press" states that John M. Thornton, of Thornton & Bros., Engrs., formerlly of Sharpsville, Mercer county, now of Mexico, has left the city for San Francisco and Guatemala, where the firm has large government railway contracts. Mr. Thornton would not talk to a reporter, but from another source it was learned that his firm is now completing 16 miles of railway in Guatemala, which is an extension of the Guatemala Central. It will ultimately be extended so as to connect with the Mexican narrow gage road, completing the line from Guatemala through Mexico. Samuel M. McKee, a well-known young man of Pittsburg, is assisting the Thornton firm in the railway construction. The firm, it is said, has some large contracts on hand for the Mexican government.

STREET AND ELECTRIC RAILWAYS.

MILFORD, MASS.—The Natick, Framingham, Ashland & Hopkinton St. Ry. Co. has made an agreement with C. W. Shipper and R. B. Green for its electric road from Hopkinton to this city. The railway will later be extended from Lincoln Square to Hopkinton over the Milford & Hopedale road. Pres., W. B. Ferguson.

HARTFORD, CONN.—The Hartford St. Ry. Co. has petitioned for permission to extend its electric road. Gen. Man., N. M. Crawford.

CLINTON, N. Y.—The construction of an electric railway from Clinton to Hartford, a distance of 5½ miles, estimated to cost $6,000 a mile, to connect with the Utica Belt Line, is being considered. A. G. Benedict, James L. Dempsey and Ellery Stebbins are interested.

CORTLAND, N. Y.—The extension of the electric railway to McGrawville is being considered. P. S. Page, of Scranton, Pa., and H. Bergholtz, of Ithaca, are interested.

LOCKPORT, N.Y.—Reed & McKibben, of New York, are reported about to begin work on the completion of four miles of the Lock City Electric Ry. They recently built the portion in the city. C. A. Johnson, of New York, is interested.

NEW ROCHELLE, N. Y.—The New York, Westchester & Connecticut Traction Co. has petitioned for permission to build its electric road in this city.

NEW YORK, N. Y.—The Central Park, North & East River R. R. Co., and the Broadway & Seventh Ave. R. R. Co., have petitioned for permission to extend their roads.

SAYVILLE, N. Y.—J. S. Hawkins, of Stony Brook, is making surveys for an electric railway through this place.

SENECA FALLS, N. Y.—We are informed that work has been commenced on the Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Co.'s road through this city, and that it will be pushed to Cayuga Lake. G. D. Grannis, of Syracuse, is the contractor. Ch. Engr., Thos. A. Mather.

ATLANTIC CITY, N. J.—The construction of an electric railway between Camden and Atlantic City is being considered. Wm. J. Thompson, of Gloucester City, James Scott, of Chester, Pa., and William Bowler are interested.

McKEESPORT, PA.—It is reported that the contract for building the extension of the Homestead & Highland Ry. from Homestead to Duquesne will soon be awarded.—Geo. T. Rehn & Co., of Hornellsville, N. Y., have been awarded the contract for extending the McKeesport, Duquesne & Wilmerding Ry. Co.'s electric road from the Wilmerding line to connect with the company's roads at Versailles.

READING, PA.—It is reported that bids will soon be opened for the construction of the Allentown-Kutztown Electric Ry. S. O. Bowman and Osmond Rambo are interested.

OPELIKA, GA.—It is reported that the Auburn & Opelika Ry. Co. is considering the question of extending its road to Tuskegee, and equipping it with electricity. Supt., John L. Cowan.

CANFIELD, O.—The township has voted to issue $20,000 in bonds to aid in the construction of the Canfield & Youngstown Electric Ry., by way of Cornersburg, to connect with the Youngstown Electric Ry. at Mill Creek Park or the Youngstown Park & Falls R. R.

MOUNT VERNON, O.—Arrangements are being made for an electric railway from Mount Vernon through Fredericktown, Luserne, Fulton, Cardington and Mount Gilead. Fred. W. Jones, Pres. Central Electric Ohio Ry. Co., is interested.

NORWALK, O.—The construction of a steam motor or an electric railway between Norwalk and North Fairfield, a distance of 4 miles, is being considered. E. S. Tuttle, E. C. Owens, L. A. Wheatmen and J. B. Andrews are interested.

HOBART, IND.—The Hobart & Western Electric R. R. Co. has been organized in Valparaiso to build a road from Hobart to Chicago. Pres., Alfred Morrison, of Chicago; Secy., A. J. Smith, of Hobart; Treas., J. H. Roper, of Hobart.

KOKOMO, IND.—Snow & Avery have been granted a franchise by the Howard county commissioners for an electric railway from Kokomo to Greentown.

TERRE HAUTE, IND.—Montgomery & Jones are making surveys for an electric railway between this city and Brasil.

FLINT, MICH.—John E. Nolan, of Saginaw, has been granted a franchise for an electric railway.

CHICAGO, ILL.—The Chicago Subway, Arcade & Traction Co. has been incorporated, with a capital stock of $15,000,000; incorporators, W. H. Passmore, Preston Gants, Geo. K. Kinney, Wm. B. Roberts, of Chicago; Chas. F. Griffin and Marvin E. Barnhart, Tacoma Bldg.—The Sanburn Electric Ry. Co. has been incorporated to build a road from Chicago through the counties of Cook, Lake, Dupage and Kane to Aurora; incorporators, Geo. O. Talbot, of De Kalb; James W. Kenny, Oscar L. Murray, Homer K. Gilpin and J. S. McGlashen, of Chicago.

DANVILLE, ILL.—The construction of an electric railway between Danville and Potomac, a distance of 20 miles, estimated to cost $200,000, is being considered. John C. Short is interested.

LA CROSSE, WIS.—The La Crosse, Black River Falls & Neillsville Electric Ry. Co. has been incorporated to build a road between the above places, a distance of about 80 miles; capital stock, $300,000; incorporators, Nathan Clark, Paul McHugh, Wm. H. Polleys, William Burns and T. J. McHugh.

GRAND ISLAND, NEB.—A company has been organized to build a street railway. H. T. J. Fuehrman, H. C. Joehuk, Joseph Sonderman and W. S. Salter are interested.

KANSAS CITY, MO.—The Kansas City & Independence Air Line R. R. Co. is considering the question of equipping its steam road with electricity. Supt., James H. Pickering.

ST. LOUIS, MO.—The St. Louis Traction Co. has petitioned for a franchise for an electric railway, and the Southern Electric Ry. Co. has petitioned to extend its road. Gen. Man., Jos. S. Minary.—The county court has granted a franchise to J. B. Clayton and others for an electric railway from a point near the limits of St. Louis to a point near Fenton, a distance of about 15 miles.

DENVER, COLO.—The Citizens' Ry. Co. has been incorporated to build an electric railway from Denver to Boulder; capital stock, $500,000; incorporators, Nillo O. Smith, Chas. A. Harver, E. S. Smith, C. M. Cobb and T. W. Potter.

SACRAMENTO, CAL.—Bids are asked until June 10 for the purchase of a franchise for constructing an electric railway. O. S. Flint, Cy. Clk.

ELECTRIC LIGHT AND POWER.

LEWISTON, ME.—William Doe, of Pennsylvania, is said to be interested in a scheme to build a dam at the Great Sheepscott Pond in Palermo, by which it is estimated to develop 3,500 HP.

UXBRIDGE, MASS.—It is reported that the Uxbridge & Northbridge Electric Light Co. is considering the question of extending its service through Uxbridge and Whitinsville.

HEMPSTEAD, N. Y.—The Hempstead Gas & Electric Co. has been granted a franchise in Far Rockaway.

LANSINGBURG, N. Y.—Bids are asked until June 10 for lighting the village by electricity. George Gramm, Village Clk.

MANLIUS, N. Y.—The question of constructing an electric light plant, to be operated by water power, is being considered. W. J. Phillips is interested.

ASBURY PARK, N. J.—Bids are asked until June 3 for 75 arc lights for five years. W. C. Burroughs, Borough Clk.

RIVERTON, N. J.—The question of bonding the town for an electric light plant is again being considered, according to reports.

SCOTTDALE, PA.—Bids are asked until June 17 for furnishing 25 arc lights for five years, as stated in our advertising columns. E. L. Rutherford, Borough Secy.

WASHINGTON, D. C.—Bids are asked by the district commissioners until June 3 for street lighting, as stated in our advertising columns.

WASHINGTON, D. C.—Bids are asked until May 27 for wiring the custom house at Philadelphia, Pa., for electric lighting, and also the U. S. building at Monroe, La. W. E. Curtis, Acting Secy. Treasury Dept.

ALEXANDER CITY, ALA.—It is reported that a committee has been appointed to solicit subscriptions to aid in the construction of an electric light plant. H. G. Davis is interested.

CULLMAN, ALA.—The construction of an electric light plant is being considered, according to reports.

JACKSON, TENN.—An ordinance is to be introduced in the council authorizing an election to be held to vote on the question of bonds for the erection of an electric light plant.

ATHENS, O.—Bids are asked until June 20 for putting in an electric light plant at the Athens State Hospital. C. O. Duniap, Supt. Bd. Trustees.

WENONA, ILL.—A company has petitioned for an electric light franchise, according to reports.

KEOKUK, IA.—An election will be held May 29 to vote on the question of erecting an electric light plant or make a contract with the Des Moines Rapids Power Co. for furnishing 15,000 HP.

DODGEVILLE, WIS.—It is reported that the council has decided to advertise for bids for electric street lighting.

WESTPORT, MO.—The council is considering the question of constructing an electric light or gas plant.

EL PASO, TEX.—Bids are asked until August 2 for furnishing 50 arc lights for five years. W. T. Kitchens, Cy. Clk.

FRESNO, CAL.—The Fresno "Republican" states that the construction has been commenced of an immense electric power plant on the north fork of the San Joaquin River, from which it is proposed to derive power for lighting and manufacturing purposes in this vicinity. The work will include 4,000 ft. of 24 to 20-in. steel pipe, having a fall of 1,410 ft. It is stated that three 300-HP. wheels will be put in at present, and others as needed.

NEW COMPANIES.—Three Cities Electric Co., Colorado Springs, Colo.; $100,000; A. A. McGovney, A. L. Lawton and E. J. Eaton.

Northern Electric Co., Norwalk, O.; $25,000; Geo. P. Jones, Parks Foster, M. C. Foster, Burton P. Foster.

Newtown Light & Power Co., Newtown, N. Y.; $20,000; J. C. Smith, Babylon; Geo. B. Gallagher, Brooklyn; Francis McKenna, Geo. S. Jarvis, Maspeth.

Williams Bridge Gas & Electric Light Co., Williams Bridge, N. Y.; $50,000; Chas. H. Royce, Franklin Paddock, New York; J. F. Tracy, Larchmont, N. J.

Cable Insulator Co., Saco, Me.; $10,000, with $300 paid in; to manufacture electrical appliances; Pres., W. P. Sargent, Boston; Treas., Samuel Oakman, Melrose.

Monrovia Electrical Power Co., Los Angeles, Cal.; $100,000, with $52,500 paid in; W. N. Monroe, C. P. Dorland, J. H. Bartle, Monrovia; H. V. Carter, J. F. Sartori, Los Angeles.

BRIDGES.

PORTLAND, ME.—The strengthening of the piers for 100 ft. on both sides of the bridge is being considered.

CONCORD, N. H.—The Concord & Montreal R. R. Co. has voted to replace the wooden bridge over the Merrimac River at Hooksett with a steel structure.

BOSTON, MASS.—Bids are asked until May 25 for the draw for Chelsea bridge, as stated in our advertising columns. B. T. Wheeler, Supt. St.

BRADFORD, MASS.—The question of strengthening the bridge between this place and Haverhill is being considered.

GREENFIELD, MASS.—The Turner's Falls & Greenfield St. Ry. Co. has been granted permission to build a bridge over the Connecticut River at Montague City. The contract for the construction will be awarded at once.—It is reported that $8,000 has been voted for a new bridge over Green River at Newton Farm.

WEBSTER, MASS.—The construction of two bridges is being considered.

ALBANY, N. Y.—Bids are asked until June 17 for the construction of a viaduct on the line of the Northern boulevard. The viaduct will be a structure supported on braced towers of iron or steel. The spans will be of plate girders as far as practicable. The entire length will be about 642 ft., and the height will average 80 to 90 ft. for most of its length. It will have a carriageway 18 ft. in width and one 6-ft. sidewalk. Horace Andrews, Cy. Engr.; Thos. J. Lanahan, Clk. Bd.

CORTLAND, N. Y.—It is reported that P. S. Page, of Scranton, Pa., and H. Bergholtz, of Ithaca, are making arrangements to receive bids for building a new bridge over the Tioughnioga River.

LOCKPORT, N. Y.—Reed & McKibben, of New York, are making arrangements to build a bridge at Exchange St. C. A. Johnson, of New York, is interested.

NEVERSINK, N. Y.—The town board has voted to build an iron bridge across the Neversink River in place of the wooden one recently destroyed.

NEW YORK, N. Y.—A bill authorizing the construction of a bridge across the East River from Canal St., this city, to Broadway, Brooklyn, was passed by the legislature, and has been approved by the mayors of both cities.—The residents of Harlem have petitioned the New York Central R. R. Co. to build a viaduct across the depot yards at 153d St.

SENECA FALLS, N. Y.—A town meeting will be held May 27 to vote on the question of building a bridge over the Seneca River at Rumsey St., estimated to cost from $3,000 to $10,000.

STAPLETON, N. Y.—The Fresh Kills bridge plans and specifications are completed by H. P. Morrison, Engr., and it is expected that bids for the construction will soon be asked.

SYRACUSE, N. Y.—Bids are asked until May 27 for constructing a stone arch bridge and a stone arch culvert over the Harbor Brook at Park Ave. H. F. Stephens, Cy. Clk.

BOONTON, N. J.—Bids are asked until June 4 for the construction of an iron bridge, as stated in our advertising columns. S. S. Lyon, Chn. Com.

MOUNT HOLLY, N. J.—Edgar A. Alcott has been engaged to prepare plans for an iron or steel drawbridge at Hainesport, estimated to cost $10,000. Bids will be asked for the construction after the plans have been approved by the government engineer.

CARNEGIE, PA.—The construction of a new bridge, estimated to cost from $12,500 to $15,000, across Chartiers Creek, at Chestnut St., Rosslyn, has been recommended.

EASTON, PA.—L. A. Francisco, of Easton, and Lewis Reichard, of Upper Mount Bethel township, have been appointed as viewers to consider the advisability of erecting a new county bridge over Allegheny Creek, in Upper Mount Bethel township, on the road leading from Easton to Portland.

NORRISTOWN, PA.—Bids are asked until June 10 for the masonry for the following five bridges: One over the Perkiomen Creek at Schwenksville; one over Park Creek, Horsham township; one over Swamp Creek, New Hanover township; one over the Wissahickon Creek, Whitemarsh township, and one over the west branch of Perkiomen Creek, Douglass township. Edward Eisenhans, Clk. Comrs.—The county court has granted a petition for the construction of a steel bridge at Airy St., to be 468 ft. in length and 40 ft. in width, estimated to cost $40,000. John Pugh, of Conshohocken; R. E. Shauer, of Pottstown, and Wm. H. Ramsey, of Lewer Merion, compose the court.

PITTSBURG, PA.—Bids are asked until May 25 for the superstructure and masonry for seven wrought iron plate girder highway bridges, and four stone arch bridges, for which about 3,800 cu. yds. of masonry will be needed. Charles Davis, County Engr.; James A. Greter, County Controller.

NORFOLK, VA.—The city engineer estimates the cost of an iron bridge over Smith's Creek, to connect with the Atlantic City ward, at $10,000.

ABERDEEN, N. C.—It is reported that the Aberdeen & West End R. R. Co. will award contracts in July for constructing bridges on the proposed extension of its road. Supt., J. R. Page.

ST. AUGUSTINE, FLA.—The St. Augustine & South Beach Ry. Co. has purchased the charter of the St. Augustine Bridge Co., and it is proposed to build a bridge to Anastasia Island.

ATHENS, ALA.—Press reports state that two steel bridges have been located in this county. The first one in South Limestone, over Piney Creek, at the residence of Commissioner Ben Nunn. The second is located in East Limestone, over Limestone Creek, near the residence of A. M. Lewis.

CINCINNATI, O.—M. J. Becker, Pittsburg, Ch. Engr. Pennsylvania Lines west of Pittsburg, writes us that the contract for the substructure work, embracing the masonry and foundations, for reconstructing the Newport & Cincinnati bridge across the Ohio River, has been awarded to Jnite & Foley, of Pittsburg, and that for the superstructure work to the Edge Moor Bridge Works. The present structure was built in 1871 and is to be removed and replaced by a new one of steel, with sufficient capacity to carry a double line of electric cars, a carriageway and a footwalk in addition to the regular steam railway traffic. This will re-

quire the lengthening of the piers, and it is proposed to increase the channel span from 400 to 500 ft. clear span, and also to lengthen the Cincinnati approach. The work will cost about $700,000.

CLEVELAND, O.—Bids are asked until May 29 for constructing the superstructure of the bridge across the Chagrin River at Bentleyville in Chagrin Falls township. Julius C. Dorn, Clk. Bd. County Comrs.

DAYTON, O.—Bids are asked until June 20 for the purchase of $20,000 of 6% bridge bonds. H. W. Lewis, Audr. Montgomery County.

IRONTON, O.—Bids are asked until June 19 for constructing an iron or steel bridge across Storms Creek at Elm St. Geo. H. Davies, Cy. Clk.

SANDUSKY, O.—It is reported that the commissioners of Erie and Huron counties have decided to rebuild the old bridge across Rattlesnake Creek on the Lockwood road leading from Milan to Norwalk.

WASHINGTON C. H., O.—Bids are asked until May 31 for constructing bridges and masonry, five contracts. T. J. Lindsey, Audr. Fayette County.

INDIANAPOLIS, IND.—Bids are asked by the commissioners of Marion county until June 6 for building a bridge over Pleasant Run, near Glenn's Valley, and a bridge over Crooked Creek near Brooklyn Heights. Joseph L. Hunter, Comr.

CHICAGO, ILL.—Bids are asked until May 29 for furnishing about 275,000 ft. of pine and 300,000 ft. of oak for bridge work for the ensuing year. W. D. Kent, Comr. Pub. Wks.

PERU, ILL.—The council has voted to advertise for bids for constructing a new double-arch bridge, estimated to cost about $18,000.

PLYMOUTH, WIS.—The council has directed the clerk to confer with bridge builders about constructing a bridge. T. F. Ackermann, Cy. Clk.

SUPERIOR, WIS.—It is reported that the Great Northern Ry. Co. will advertise at once for bids for constructing about 700 ft., with the exception of the woodwork and masonry, of the Belknap St. viaduct. The masonry will be completed June 11, and the entire viaduct about August. Bridge Engr., Max Toltz, St. Paul; A. T. Thomas, Cy. Engr.

MANKATO, MINN.—Press reports state that the townships of Courtland and Cambria have raised $2,300 towards building a bridge over the Minnesota River between this place and New Ulm. The structure will cost $3,500.

AHNENA, KAN.—Bids are asked until May 28 for constructing an iron bridge across the Prairie Dog River, two miles east of this place. John Templeton, Trustee Township Bd.

LEAVENWORTH, KAN.—The Missouri Valley Bridge Co., of Leavenworth, has been awarded the contract for constructing three iron bridges in Leavenworth county at $5,700, the other bidders being as follows: O. C. Chapin, Springdale, Kan.; Farnsworth & Blodgett, Kansas City, Mo.; E. Moyer & Camp, Valley Falls, Kan.; J. W. Hoover & Co., Kansas City, Mo.; O. E. A. Campbell, Council Bluffs, Ia.; Kansas City Bridge Co., Kansas City, Mo. J. W. Niebaus, County Clk.

BUTTE, MONT.—Bids are asked until June 13 for constructing a one-span wooden Howe truss bridge 100 ft. long and 16 ft. wide over the Big Hole River at Upper Chalk Bluffs, 36 miles from this city. D. J. Charles, Chn. Bd. Comrs., Silver Bow County.

CENTRAL CITY, NEB.—Bids are asked until June 14 for constructing a five-span bridge over the Wood River. J. E. Howland, Merrick County Com.

DALLAS, TEX.—Bids are asked by the commissioners' court for bridgework, etc., in Dallas county. L. H. Hughes, County Clk.

MONTREAL, QUE.—The Canadian Bridge Co. has been awarded the contract for constructing the bridges on the extension of the Atlanta & Lake Superior Ry., noted last week. The work includes one bridge 1,900 ft. in length, one 1,300 ft. in length and several smaller ones, according to local papers.

HAWKESBURG, ONT.—It is reported that surveys have been made for a bridge over the Ottawa River at this place for the Great Northern Ry. Co.

LONDON, ONT.—Bids are asked until June 15 for the construction of two steel bridges, as stated in our advertising columns. Ormsby Graydon, Resident Engr., London & Port Stanley Ry.

BUILDINGS.

NORTH ADAMS, MASS.—It is reported that bids will be asked at once for the construction of the new brick normal school building, 132 × 84 ft. and three stories in height.

PROVIDENCE, R. I.—It is reported that a Boston syndicate has purchased the land on Custom House and Westminster Sts. from the Grosvenor estate, on which it is proposed to erect a nine-story building, to cost $1,000,000.——The legislature has passed a bill appropriating $100,000 to aid in the construction of a state armory, estimated to cost from $200,000 to $300,000, on the site of the old state prison.

MELROSE, MASS.—Bids are asked until May 25 for building the central fire station house. Arch., Lewis A. Dow; John P. Deering, Chn. Com.

PROVIDENCE, R. I.—Bids are asked until May 27 for building two school houses. Archs., Martin & Hall, Industrial Trust Bldg., and Fred E. Field, 48 Custom House St.; David Burton, Chn. Com.

BROOKLYN, N. Y.—Bids are asked by the committee of the board of supervisors of Kings county until May 27 for improving the county court house. Daniel Ryan, Supt. Construction; Thos. F. Farrell, Clk.——The governor has signed the bill appropriating $100,000 for making alterations to the 47th Regiment armory.

HORNELLSVILLE, N. Y.—A special election will be held June 10 to vote upon the question of bonding the city for $30,000 to build a city hall and court house.

NEW YORK, N. Y.—Plans have been filed by John T. Williams, 54 Franklin St., for a 15-story brick office building at 25 to 29 William St. and 36 and 38 Exchange Place, to cost $800,000.——Three brick hospital buildings are to be erected by the board of health near 116th St. and Avenue C, estimated to cost $75,000.

NEW YORK, N. Y.—Bids are asked by the armory board until June 10 for altering and making an addition to the rifle range in the Seventh Regiment armory building at Park Ave. and 66th St., and until June 10 for erecting an additional gallery and putting in electric light fixtures in the armory building at Ninth Ave. and 61st St. Arch., John R. Thomas, 160 Broadway.——It is reported that Meyer Jonasson & Co., Franklin St. and Broadway, will erect a 14-story building, estimated to cost about $250,000, at Broadway and 12th St. Arch., Geo. B. Post.

TROY, N. Y.—Bids are asked until May 28 for erecting two school houses. E. O. Ross, Secy. Comptroller's Office.

WEST POINT, N. Y.—James O'Toole, 348 East 84th St., New York, has been awarded the contract for erecting the Cullum Memorial Hall, estimated to cost $300,000, as advertised in Engineering News. Archs., McKim, Mead & White, New York.

ATLANTIC CITY, N. J.—It is reported that the construction of a six-story brick hotel, estimated to cost $2,000,000, probably on land owned by the Chelsea Beach Improvement Co., is being considered. Aoram Strauss, of R. H. Macy & Co., New York, is interested.

RAHWAY, N. J.—Work will soon begin on the construction of a new brick state reformatory building, for which the legislature appropriated $100,000 last winter. Arch., J. B. Thomas.

PHILADELPHIA, PA.—It is reported that bids are asked by Frank Miles Day & Bro. for the erection of a six-story office building at 1521 Sansom St.——Plans have been prepared by Addison Hutton, Fourth and Chestnut Sts., for a 235 × 50-ft. brick addition, estimated to cost $250,000, to the Aldine Hotel, eight stories in height.

PHILADELPHIA, PA.—Plans and specifications will be received until Oct. 1 for an art building, to be erected in Fairmount Park, as stated in our advertising columns. Russell Thayer, Ch. Engr.

WILKES BARRE, PA.—Bids are asked until May 31 for constructing a stone court house. Arch., E. E. Myers, Detroit, Mich.; James M. Norris, Ch. Clk. County Comrs.

WASHINGTON, D. C.—Bids are asked by Wm. Martin Aiken, Supervising Arch., for public building work as follows: Until June 6 for approaches to the public building at Scranton, Pa.; June 12, approaches at Lewiston, Me.; June 14, stone and brick work on second, third and fourth stories and tower, etc., for post office building at Richmond, Ky.——It is reported that the congregation of the Protestant Episcopal church will erect a cathedral. Arch., Ernest Flagg, of New York.

WASHINGTON, D. C.—Bids are asked until June 17 for furnishing brick, cement, lime, terra cotta, etc., for a building to be erected on the site of the government printing office stables. Col. John M. Wilson, U. S. Engrs., Pub. Bldgs. and Grounds.

GOLDSBORO, N. C.—Bids are asked until June 1 for erecting an annex to the eastern asylum. Arch., A. G. Bauer, Raleigh; Dr. J. F. Miller, Supt.

NASHVILLE, TENN.—The legislature has passed a bill authorizing the erection of a new penitentiary, to cost $350,000.

CLEVELAND, O.—It is reported that the foundations are being built for the Lakeside hospital, estimated to cost about $400,000.

WABASH, IND.—Bids are asked by the Cleveland, Cincinnati, Chicago & St. Louis R. R. Co., Cincinnati, O., until June 1 for erecting the following buildings, estimated to cost $100,000, exclusive of machinery: A main shop, 224 × 222 ft., with court in center, 161 × 97 ft.; machine shop, 100 × 60 ft.; tin shop, 29 × 34 ft.; engine room, 40 × 35 ft.; lavatory and toilet, 24 × 11 ft.; mill shop, 60 × 80 ft.; boiler shop, 60 × 80 ft.; erecting shop, 60 × 161 ft., and office, 37 × 22 ft. The plans of round house call for 22 stalls. Oil house and store room, 32 × 75 ft.; carpenter shop, 60 × 79 ft.

DETROIT, MICH.—It is reported that a Pittsburg architect is preparing plans for an eight-story hotel, estimated to cost $4,000,000, 250 × 276 ft., on West Fort St., on property owned by James McMillan, the Avery heirs and Mrs. W. J. Chittenden.

CHICAGO, ILL.—The Probst Construction Co., Schiller Bldg., has been awarded the contract for erecting the Chicago Coliseum, at 63d St. and Madison Ave., estimated to cost $250,000. Arch., S. S. Beman.——An addition is to be made to the county jail on Illinois St. and Dearborn Ave., to cost $100,000. Arthur G. Morey, County Arch.——The Western Electric Co. has been granted a permit to build a two-story factory, 180 × 49 ft., at 242 to 258 Jefferson St., to cost $140,000.——D. H. Burnham & Co., Rookery Bldg., is preparing plans for a theatre, hotel and office building, estimated to cost about $900,000, to be erected adjoining the Great Northern Hotel at Dearborn and Jackson Sts. for the Great Northern Theatre & Hotel Co.

CHICAGO, ILL.—The Union Bldg. is to be erected at Grand Ave. and Noble St. It will be of brick, six stories in height, 125 × 50½ ft., and will cost $150,000. Arch., Carl Nielsen.——The Illinois Central R. R. Co. has been granted a permit to build five one-story car shops in South Chicago, estimated to cost $500,000.

BEDFORD, IA.—The construction of a new county jail is being considered.

BOONE, IA.—It is reported that the board of supervisors is discussing the question of constructing a new county jail.

DUBUQUE, IA.—It is reported that an insane asylum is to be erected at Asbury, estimated to cost $125,000, for the sisters of mercy hospital.

MOUNT AYR, IA.—The contract is said to have been awarded by the board of supervisors for a new county jail.

ST. LOUIS, MO.—The congregation of the Second Presbyterian Church has had plans prepared for a new brick and stone structure, 150 × 145 ft., estimated to cost $105,000, on Westminster and Taylor Aves. Archs., Shepley, Rutan & Coolidge.

TYLER, TEX.—L. W. Wells, of this place, has prepared plans for the Texas Fruit Palace with an auditorium with a seating capacity of 6,000. The building will be used for exposition purposes, and will cost about $20,000.

LOS ANGELES, CAL.—It is reported that a hotel, estimated to cost $600,000, is to be erected upon the site of the 10th St. hotel. Arch., E. D. Cardiele.

NANAIMO, B. C.—Bids are asked until May 31 for the erection of a court house. W. S. Gore, Deputy Comr. of Lands and Works, Victoria.

WATER-WORKS.

MECHANIC FALLS, ME.—A town meeting was held Saturday to consider the question of works; proposed supply from wells.

RUMFORD FALLS, ME.—The Rumford Falls Light & Water Co. has purchased 1½ miles of pipe, which will be laid through the resident section this summer, according to reports.

YARMOUTH, ME.—Frank Buchanan, Town Clk., writes us that the town will construct works to cost $40,000. Plans and specifications are now being made. Geo. W. Hammond, Chn. Com.

KEENE, N. H.—Several plans for securing an adequate supply of pure water are being prepared, and the commissioners have recommended that another pipe line be laid from Roaring Brook to the octagon reservoir, at an estimated cost of $9,800. Another plan considered was for an $8,500 filter plant.

PORTSMOUTH, N. H.—Frank Jones is reported as having surveys made for an independent water supply for his breweries. It is stated that he considers the $5,000 a year that he is now paying for water as excessive, and that he will put in private works.

SOMERSWORTH, N. H.—A petition is reported as being generally signed by the citizens asking the council to establish municipal works.

WEST RUTLAND, VT.—A special meeting of the fire district was held May 22 to consider the subject of an aqueduct system for fire protection, at an estimated cost of $6,000.

BELMONT, MASS.—At a special town meeting May 20 the town voted to make extensions to cost about $8,000.

GREENFIELD, MASS.—Fire district No. 1 has been authorized by the legislature to secure a water supply from Green River.

HOLLISTON, MASS.—At a special town meeting May 16 the selectmen were instructed to contract with the Holliston Water Co. for 45 hydrants for five years, at $35 per hydrant per year. W. H. Smart, Secy. Com.

LEXINGTON, MASS.—A special town meeting will be held May 25 to consider the purchase of the plant of the Lexington Water Co.

LOWELL, MASS.—Bids are asked until June 6 for the construction of a tube well plant, as stated in our advertising columns. Geo. Bowers, Cy. Engr.; Miles F. Brennan, Pres. Bd.

MELROSE, MASS.—A bill has been approved permitting this town to issue $50,000 in bonds as an additional water loan.

MILLBURY, MASS.—The Millbury Water Co. has contracted with the Barr Pumping Engine Co., of Philadelphia, for a 750,000-gallon pumping engine. This is in addition to the contract noted last week.

NORTH ADAMS, MASS.—The fire district has voted to increase its indebtedness $110,000 for building reservoirs and extending the mains.

NORTH ADAMS, MASS.—Bids are asked until June 10 for constructing two earth dams, with masonry core, etc., as stated in our advertising columns. V. A. Whitaker, Chn. Com.

NORWOOD, MASS.—Bids are asked until June 10 for the purchase of $8,000 in 4% water bonds. Chas. E. Pond, Town Treas.——The commissioners have been authorized to issue $20,000 in bonds for extensions. E. J. Shattuck, Chn.

WALPOLE, MASS.—At a town meeting May 16 it was voted to issue $100,000 in 30-year 4% bonds for a water supply from Low's Brook.

WEBSTER, MASS.—It is probable that a special town meeting will soon be held to vote on an issue of $20,000 in bonds for extending and improving the water-works.

WENHAM, MASS.—The town has been authorized to issue $20,000 in bonds for a water supply.

WORCESTER, MASS.—The committee has recommended 12-in. extensions, to cost about $3,500.

GREENWICH, CONN.—The Greenwich Water Co. is reported as considering a proposed extension of the mains to Cos Cob and Mianus.

NEW BRITAIN, CONN.—The commissioners have voted in favor of extensions in several streets.

SUFFIELD, CONN.—The governor has signed the bill incorporating the Village Water Co. of Suffield.

AFTON, N. Y.—It is reported that E. D. Smalley, of Syracuse, is making plans for gravity work estimated to cost about $20,000.

ANTWERP, N. Y.—E. P. Perley writes us that Frank A. Hinds, of Watertown, is preparing plans for works, for which the village has recently appropriated $25,000. The details will be completed as soon as possible.

BINGHAMTON, N. Y.—The commissioners are selecting a site for the proposed new reservoir, for which the city has been authorized to issue bonds. John Anderson, Secy.

BUFFALO, N. Y.—Bids were opened May 15 for securing an increased water supply at the lower pumping station, according to five different plans. It is statel that the bil of A. C. Douglass, of Niagara Falls, to construct a tunnel parallel to the present one, with a capacity of 200,000,000 gallons in 24 hours, at $74,600, was the lowest, and will probably be accepted. Dwyer & McNaughton and Collis & Hingston were the other bidders.

BUFFALO, N. Y.—Bids are asked until June 4 for increasing the supply of water at pumping station from Niagara River, according to five plans. R. G. Parsons, Secy. Dept. Pub. Wks.

CARTHAGE, N. Y.—F. P. Phillips, Clk., West Carthage, writes us that no official action has yet been taken towards securing works in West Carthage, although the matter is being agitated by the citizens.

CENTRAL BRIDGE, N. Y.—The Central Bridge Water Co. has been incorporated with a capital stock of $25,000, by D. W. Jenkins, W. D. Becker, J. W. Wessell and others of this village.

CHERRY VALLEY, N. Y.—It is reported that works will soon be put in.

COLD SPRING, N. Y.—We are informed that no plans have yet been prepared for the proposed works,

for which $30,000 in bonds have been voted, as noted last week. Capt. Henry H. Metcalfe, Pres. Bd.

FORESTVILLE, N. Y.—Bids are asked until June 10 for constructing works, including about 21,000 ft. of 20 to 4-in. pipe, 20 hydrants, etc., as stated in our advertising columns. S. W. Reynolds, Pres. Comrs.

FORT ANN, N. Y.—The residents of this place are reported to have voted to abandon the present source of water supply and the pumping system, and as to secure a gravity supply from springs.

FREDONIA, N. Y.—C. A. Clute, Clk., writes us that nothing definite has yet been decided in regard to the proposed extensions. It is probable that the question will be submitted to the taxpayers within a few weeks. E. A. Wilder, of this place, has prepared plans for an additional storage reservoir, as recently noted in these columns. The work will include a dam about 60 ft. high and 200 ft. long.

GLOVERSVILLE, N. Y.—The water board is considering the question of extensions in several streets.

GREENWICH, N. Y.—H. C. Gray, Supt. Union Water-Works Co., writes us that the contract for four miles of 8 and 6-in. pipe for an additional supply has been awarded to R. D. Wood & Co. Engr., John Marsh, North Adams, Mass.

HEMPSTEAD, N. Y.—A special election will be held May 29 to vote on an appropriation of $46,650 for municipal works.

LAURENS, N. Y.—Bids will be asked within a few weeks for constructing works, for which $8,000 has been voted. F. L. Winsor, Clk., writes us that about two miles of 8-in. pipe and 13 hydrants will be required.

LITTLE FALLS, N. Y.—Hiram Boyer is reported as contemplating the construction of works in this city.

LOWVILLE, N. Y.—W. H. Eggleton, Cy. Clk., writes us that the citizens have voted to issue $5,000 in bonds, to be used with the $3,000 now in the hands of the commission, for the construction of a reservoir.

MADISON, N. Y.—The village is considering the construction of works, which E. D. Smalley, of Syracuse, is reported to have stated would cost about $12,000, the supply to be pumped from a spring into a reservoir.

MONTGOMERY, N. Y.—Bids are asked until June 14 for constructing works, as stated in our advertising columns. Engr., Alexander Potter, New York; Chauncey Brooks, Pres. Comrs.

MOUNT VERNON, N. Y.—The plant of the New York City Suburban Water Co. has been sold to Charles Bard and Newman Erb for $50,000, these gentlemen representing the holders of $1,250,000 of the stock of the company.

ONEIDA, N. Y.—The water commissioners are reported to have engaged the Stanwix Engineering Co. to make surveys and plans for new works, and it is stated that an offer has already been received to duplicate the present plant for about $100,000. The proposition of the Warner Water-Works Co. is to sell its plant for $161,000, which is considered excessive.

PAINTED POST, N. Y.—It is reported that an election will soon be held to vote on an issue of $20,000 in bonds for works.

PERRY, N. Y.—It is reported that efforts will be made to secure works at this place this summer.

PHELPS, N. Y.—E. D. Meade, Member of Com., writes us that a committee has been appointed to consider the question of purchasing the present works or constructing a new plant. Estimates on pipe are now wanted.

PHILMONT, N. Y.—The question of works is being considered. Chas. B. Gore, Cy. Engr., Hudson, N. Y., is reported to have been in the city last week investigating the question of a supply.

SAUGERTIES, N. Y.—James Dederick, Clk., writes us that the Consumers' Water Co. has been organized to construct works at this place.

STAMFORD, N. Y.—The Center Valley & Highland Mills Water Co. has been incorporated with a capital stock of $25,000; directors, W. H. and M. M. Cowan, of Montgomery; C. A. Crowell, R. H. Barber, A. M. Warner and others, of Stamford.

STAPLETON, N. Y.—Henry P. Morrison, County Engr., is preparing plans for a water supply for the county house, for which $3,000 has been appropriated.

TULLY, N. Y.—H. K. King, Clk., writes us that nothing has been done for works except to levy the assessment which has been voted. No commissioners have yet been appointed by the board.

YONKERS, N. Y.—Bids are asked until June 6 for removing two old and setting two new boilers. Wm. H. Doty, Pres. Comrs.

ARLINGTON, N. J.—The Kearny township committee has votel to advertise for bids until May 28 for a water supply for 5 to 25 years.

HADDONFIELD, N. J.—John Gill and Samuel Bacon are members of one company and Charles Hillman and John Peyton of another company, each of which proposes to construct works on Haddon Heights.

TRENTON, N. J.—It is stated that the commissioners have practically decided to rescind the action of last week in awarding contracts for $20,000 worth of work at the pumping station without advertising for bids and that bids will soon be asked for the work. These contracts were noted in our issue of last week.

WEST ORANGE, N. J.—There is talk of purchasing the plant of the West Orange Water Co. It is stated that this can now be bought for about $90,000, and that the next chance to purchase the same will be in 15 years.

ALLEGHENY, PA.—Bids are asked until June 3 for furnishing water pipe, pig lead, valves, hydrants, castings, etc. Robt. McAfee, Dir. Pub. Wks.

ALLEGHENY, PA.—Specifications for the new pump house at Nine-Mile Island are about completed.

AMBLER, PA.—The Ambler Spring Water Co. is reported about to construct a large stone reservoir.

BELTZHOOVER, PA.—The council is considering an ordinance granting a franchise to the St. Clair Water Co., which offers fire plugs at $20 each a year. The Monongahela Water Co., which now furnishes the borough, asks $50.

BETHLEHEM, PA.—The West Bethlehem council has directed the secretary to secure bids for a supply of cast iron pipe.

CARNEGIE, PA.—The council is reported about to contract for 100 fire hylrants. It is stated that the Monongahela Water Co. and the St. Clair Water Co. are both bidding for the contract.

DUQUESNE, PA.—A committee has been appointed to investigate the question of works. S. H. Young, Pres. Council.

HARRISBURG, PA.—The Cumberland Water Co. is reported to have awarded a contract for the construction of a plant at Boiling Springs to develop the water power there. Pres., J. C. Bucher; Secy., J. A. Herman; Treas., H. T. Duke.

HELLERTOWN, PA.—George B. Deemer, Clk., writes us that the council is searching for a water supply, which can probably be secured about two miles out of town; if not, wells may be sunk.

MEADVILLE, PA.—Bids are asked until June 1 for the purchase of $75,000 in water bonds. R. E. Meyers, County Controller.

MONACA, PA.—It is reported that J. T. Leaf, of Rochester, Pa., has been engaged to prepare plans for works.

MOUNT HOLLY SPRINGS, PA.—Robert E. Wright, Secy. Mount Holly Water Co., writes us that the contract for pipe, valves, etc., has been awarded to R. D. Wood & Co., and that for the construction to E. S. Whitney, of Allentown, who prepared the plans.

QUAKERTOWN, PA.—The contract for works is reported to have been awarded to C. Jesse Young, at about $60,000.

SELLERSVILLE, PA.—Warren F. Cressman has been engaged as engineer of proposed works. Prof. H. T. Williams, Secy. Com.

SOUDERTON, PA.—Steps are being taken to organize a company to construct works; the supply to be by gravity from East Souderton.

WEST BROWNSVILLE, PA.—J. D. S. Pringle, Burgess, writes us that G. W. Jenkins, County, Surv., is preparing plans for works, for which the citizens have recently voted; supply from Monongahela River, population, 751.

WILMERDING, PA.—Bids are being received by the Hurtle Creek Valley Water Co., for a 3,000,000-gallon pumping engine. The company is now putting in a duplicate force main. John F. Miller, Supt.

BALTIMORE, MD.—S. M. Gray, of Providence, has been engaged as consulting engineer to advise the water board in regard to proposed extensions.

CUMBERLAND, MD.—The water board has recommended an appropriation of $15,000 for securing a supply from the Potomac River. The board is reported as considering the purchase of three acres of land for filtering purposes, the work to cost about $65,000.

MOUNTAIN LAKE PARK, MD.—The contract for the masonry on the new works is reported to have been awarded to H. C. Hallock, of Wheeling. Engr., A. L. White, Wheeling, W. Va.

SALEM, W. VA.—The contract for works has been awarded to Hoge & White, of Wheeling, at $4,000.

GREENSBORO, N. C.—A press report states that the water-works plant was offered for sale at auction last week, but that there was no bidder.

BUENA VISTA, GA.—C. Horace McCall writes us that this village is talking of putting in works to cost $5,000 to $10,000. It is proposed to pump the supply from springs with rams. No contract has yet been awarded.

KEY WEST, FLA.—The city clerk writes us that the contract for sinking an artesian well and constructing works was awarded last July to D. Lamar, as noted in these columns at that time, and by him assigned to a party who assigned it to the Virginia Paving & Construction Co., of Lynchburg, Va. This company is now constructing the plant. The artesian well is down about 1,600 ft.; and the stand-pipe and pumping station are nearly erected. The contract price is $95,500, payable in 6% bonds.

OCALA, FLA.—W. L. Jewett, Cy. Clk., writes us that an ordinance is now before the council authorizing an issue of bonds to purchase the plant of the Ocala Water Co., or to build new works. The question will have to be submitted to a vote of the people before bonds can be issued.

CULLMAN, ALA.—The city is reported about to construct works and an electric light plant.

MARION, ALA.—It is stated that bonds will be issued for works.

NEW ORLEANS, LA.—Bids are asked until May 29 for laying about 2,300 ft. of 6-in. water pipe. L. H. Gardner, Supt. Water-Works Co.

CHATTANOOGA, TENN.—Plans are being made, according to reports, for a 30,000-gallon water tower, to be built of iron and stone.

CLEVELAND, TENN.—The contract for works is said to have been awarded to the National Water-Works Co., of Pittsburg.

MOUNTAIN CITY, TENN.—Bids are being received, according to a press report, for constructing works estimated to cost $25,000.

ASHLAND, KY.—The Ashland Water Supply Co. is reported about to construct a new intake pipe from the pumping station to the river bed.

HARTFORD, KY.—A company is being organized to construct works, which will include an iron reservoir, according to reports.

LOUISVILLE, KY.—The Louisville Water Co. is investigating the question of filters. It is stated that one company will have a trial plant in operation by June 1 and another company one by July 1.

MIDDLESBORO, KY.—Press reports state that the Town Co. will soon begin the completion of the works.

BARBERTON, O.—It is stated that a pumping station will soon be added to the works.

DAYTON, O.—Bids are asked until May 29 for sinking eight additional wells at the National Home near this city. M. McCoy, Treas. Address National Military Home, Ohio.

MANSFIELD, O.—The trustees are reported as about to ask for an appropriation of $10,000 for an air-lift pump.

TOLEDO, O.—The council is considering a proposed issue of $150,000 in bonds for extensions. It is stated that $100,000 of this amount will be required for laying 36-in. pipe in place of 30-in. now in use, and that the remaining $50,000 will be spent for extensions of the mains.

DECATUR, IND.—The contract for works, as advertised in Engineering News, is reported to have been awarded to the Howe Pump & Engine Co., of Indianapolis, at $65,000. The bids were opened May 13.

EVANSVILLE, IND.—Local papers state that the board of health has received a report from a chemist who recently examined samples of the water supply, stating that only one out of 13 samples was free from typhoid bacilli.

GARRETT, IND.—The water question was voted upon at an election this week.

MICHIGAN CITY, IND.—An election will probably be held in June to vote on an issue of bonds for securing a new supply and making other improvements.

GLADSTONE, MICH.—It is reported that an election will soon be held to vote on the question of works and an electric light plant.

KALAMAZOO, MICH.—The council has voted in favor of extensions, to cost about $9,000.

MARLETTE, MICH.—H. C. Morris, Village Clk., writes us that the question of works is being agitated, but that no definite action has yet been taken.

YPSILANTI, MICH.—Bids will soon be asked, according to reports, for sinking a new well.

CHICAGO, ILL.—Bids are asked until May 29 for furnishing composition hydrant and valve basins during the ensuing year. W. D. Kent, Comr. Pub. Wks.

ELMWOOD, ILL.—Bids are asked until June 21 for constructing works, as stated in our advertising columns. Consult. Engr., Chas. F. Sturtevant, St. Louis; Z. L. Gilbert, Cy. Clk.

LATHAM, ILL.—W. D. Griffin writes us that the question of works is being agitated by the citizens.

PARIS, ILL.—The contract for a dam across Sugar Creek is reported to have been awarded to the Granolithic Pavement Co., of Springfield, at about $15,000.

ELKHORN, WIS.—It is reported that a special election will be held June 4 to vote on an issue of $18,000 in 6% bonds for the construction of works. R. A. McCarthy, Clk.

INDEPENDENCE, WIS.—It is reported that works to cost $6,000 will soon be put in, the water supply to be from artesian wells.

JUNEAU, WIS.—Bids are asked until June 4 for the construction of works, for which $4,500 in bonds was recently voted, as noted in our issue of May 9. The city clerk writes us that the city already has a pump and engine. J. H. Haskell, of Fairbanks, Morse & Co., prepared the plans.

TOMAH, WIS.—The council is reported to have awarded the contract for constructing works to Anderson & Walher.

TREMPEALEAU, WIS.—E. J. Hankey, Village Pres., writes us that there is serious talk of constructing works, and that the question will probably soon be submitted to a vote of the taxpayers. As at present proposed, only 1,350 ft. of main will be required; the supply to be from the Mississippi River.

DUBUQUE, IA.—The aldermen are reported as again agitating the question of municipal works, as the water company is said to refuse to make desired extensions.

LAKE MILLS, IA.—At an election May 15 the citizens voted on a proposition to issue $2,400 in bonds, in addition to the $2,000 already authorized, for works.

MANCHESTER, IA.—Chas. H. Day, Cy. Clk., writes us that the contract for sinking an artesian well for this city has been awarded to J. P. Miller & Co., of Chicago, work to begin June 1.

MASON CITY, IA.—The council has ordered extensions, for which it is stated that 100 tons of pipe will be required.

PELLA, IA.—John Faassen, Cy. Clk., writes us that J. P. Miller & Co., of Chicago, have been engaged to drill one or more wells for a water supply, for which bonds will soon be sold. The city will issue $19,000 in bonds.

REMSEN, IA.—At an election May 27 the citizens will vote on an issue of $3,900 in water bonds.

WILLIAMS, IA.—The contract for works has been awarded to the U. S. Wind Engine & Pump Co., of Batavia, Ill. Water will be pumped from wells to a tank erected on a 70-ft. steel tower.

FARIBAULT, MINN.—The contract for sinking an artesian well has been awarded to J. M. McCarthy.

LAKE CITY, MINN.—Bids are asked until May 27 for the purchase of $2,500 in water extension bonds. S. M. Simpson, Cy. Recdr.

SPRING GROVE, MINN.—S. H. Ellestad, Village Recdr., writes us that the Challenge Wind Mill & Feed Mill Co., Batavia, Ill., has prepared plans for works at this place; supply from deep well; population 600.

COFFEYVILLE, KAN.—T. H. Brooks, Cy. Clk., writes us that the city has voted to issue bonds for works, as stated last week, but that no other steps have yet been taken. The plans were prepared by Tuttle & Pike, Kansas City, Mo., last fall, and noted quite fully in our issue of Jan. 3; estimated cost, exclusive of land, about $73,000.

MITCHELL, S. DAK.—The council is considering proposed extensions in several streets. A. C. Pollard, Pres.

MEADVILLE, MO.—A. K. Bailey, Cy. Clk., writes us that a tax was voted at the spring election for the purpose of sinking a well, erecting a wind mill, etc., but that it will not be collected until this winter, and there is now talk of voting bonds for the erection of works; population, 1,000.

UNION, MO.—At an election May 14 the citizens voted to issue bonds for works.

OMAHA, NEB.—The South Omaha Water-Works Co. has been incorporated, with a capital stock of $1,000,000, commencing with $500,000, by W. A. Paxton, John A. Creighton and Louis Schroeder.

BRENHAM, TEX.—Bids are asked until May 27 for extensions of the mains. J. A. Wilkins, Mayor.

BLOOMING GROVE, TEX.—It is reported that the entire capital stock of $10,000 of the Blooming Grove Water Co. has been subscribed.

ENNIS, TEX.—Bids are asked by the Ennis Cotton Oil Co. for boring an artesian well.

LANCASTER, TEX.—The Lancaster Water, Light & Ice Co. has been incorporated with a capital stock of $15,000. Information sent us by W. A. Strain, Secy. of the company, was published last week.

TERRELL, TEX.—The council has elected S. M. Swindell and M. O. Nowlin to superintend and manage the works.

SUISUN CITY, CAL.—The Suisun & Fairfield Water Co. has offered to sell its plant to the town for $5,000.

OTTAWA, ONT.—Bids are asked until May 28 for earth and rock excavation required for extensions during 1895. Robert Surtees, Cy. Engr.

IRRIGATION.

EL PASO, TEX.—Press reports state as follows: It has been announced that the required $2,500,000 has been raised in London for the construction of an irrigation dam across the Rio Grande River at Rincon, N. Mex., above El Paso. Local directors of the corporation will build long irrigation canals through the valley from Rincon to Fort Hancock, below El Paso.

ALBION, IDAHO.—Frank Riblett, ex-County Surv., can give information in regard to one or more irrigation projects in this vicinity.

WEISER, IDAHO.—The "Signal" states that the farmers of upper Boise valley have determined to form an irrigation district under the provisions of the law passed by the last legislature similar to the California law. The district will embrace all the irrigable lands under the Ridenbaugh, Settlers and Phillis canals, aggregating 140,000 acres; negotiations will open at once for the purchase of these canals. If satisfactory terms can be agreed upon bonds will be floated to purchase the waterways, if not, the farmers will endeavor to float bonds to build new ones.

NEW COMPANIES.—Valley Irrigation Co., Weiser, Idaho; $20,000, with $2,010 paid in; it is proposed to extend the Jeffrey ditch; Charles Fosselman, John D. Mattheson, C. S. Dunphey.

High Line Ditch Co., Billings, Mont.; $10,000; to build irrigation ditches; I. D. O'Donnell, Joseph Zimmerman, James Steele, Stephen Haid.

Orchard & Alfalfa Irrigation Co., Cozad, Neb.; $40,000; to build irrigation ditches in Dawson county; Geo. O. Brown, D. H. Brooks, E. A. Lutes, E. M. Young.

South Antelope Valley Irrigation Co., Los Angeles, Cal.; $400,000, with $500 paid in; Nathan Cole, Jr., L. G. Parker, E. C. Chapin, D. P. Hatch, Los Angeles; Burt Cole, Little Rock.

Lenox Cove Ditch Co., Visalia, Cal.; $9,000, with full amount paid in; J. W. C. Pogue, Lemon Cove; John F. Jordon, Wm. H. Hammond, Visalia; A. H. Tenbrook, Alameda, Cal.

Appleton Land & Water Co., Los Angeles, Cal.; $500,000, with $210,000 paid in; to build irrigation ditches, etc.; P. L. Griffin, Riverside; L. E. Palmer, Pasadena; J. E. Wilson, Santa Fe Springs; A. L. Work, J. B. Hartwell, Los Angeles.

SEWERAGE.

DOVER, N. H.—Ernest W. Bowditch, of Boston, has been engaged to prepare plans for a system.

MANCHESTER, N. H.—Plans have been prepared for a brick sewer in Silver St., estimated to cost about $15,000. W. H. Bennett, Cy. Engr.

PORTSMOUTH, N. H.—The mayor has recommended the improvement of the system or the construction of a new system.

ROCHESTER, N. H.—Plans have been prepared for extending the system in East Rochester, and it is reported that work will begin very soon. Engr., Ernest W. Bowditch, of Boston.

FALL RIVER, MASS.—The extension of the Cove St. sewer to deep water is being considered.

MILTON, MASS.—The town has been authorized to issue $100,000 in bonds for a system of sewers.

SOUTH FRAMINGHAM, MASS.—Bids are asked until May 27 for furnishing 400 bbls. of English Portland cement, about 29 tons of 10 to 8-in. cast iron water pipe and 1½ tons of special castings. John H. Goodell, Chn. Drainage Com., Framingham.

WEBSTER, MASS.—Lucian A. Taylor, of Boston, has been engaged to prepare plans for a system. L. J. Upham, Town Clk.

WATERBURY, CONN.—The city engineer has been directed to advertise for bids for constructing sewers in four streets.

AUBURN, N. Y.—D. F. Austin, Cy. Surv., writes us that 5,640 ft. of 24-in. brick, 5,332 ft. of 18 and 15-in. pipe, and 1,085 ft. of 24-in. riveted steel sewers will probably be constructed soon.

AUBURN, N. Y.—Bids are asked until June 3 for the construction of a brick and pipe sewer, as stated in our advertising columns. F. B. Ives, Cy. Clk.

BINGHAMTON, N. Y.—It is proposed to construct 1,500 ft. of 12 to 8-in. pipe sewers, estimated to cost about $2,000. Lewis Seymour, Cy. Clk.

BROOKLYN, N. Y.—Bids are asked until June 4 for constructing sewers. A. T. White, Comr. Cy. Wks.

BROOKLYN, N. Y.—Bids are asked until June 3 for the purchase of $100,000 of 26th Ward sewer bonds.

BUFFALO, N. Y.—Bids are asked until June 4 for constructing 12 and 10-in. pipe sewers in two streets. R. G. Parsons, Secy. Dept. Pub. Wks.

COLLEGE POINT, N. Y.—Bids are asked until June 3 for constructing sewers in Fourth Ave. and a basin in First Ave. Richard Lutters,, and J. Oppenheimer, Com.

FLUSHING, N. Y.—Bids are asked by the board of trustees until June 4 for constructing a sewer in Amity St.

FONDA, N. Y.—Bids are asked until May 24 for constructing a system, estimated to cost $9,500.

FULTON, N. Y.—The board of health is circulating a petition to secure a system on plans on a more limited scale than those that were defeated at an election held April 4, as noted in our issue of last week. Anin Rice, Clk. Comrs.

GENEVA, N. Y.—An election was held May 20 to vote on the question of constructing a system, estimated to cost about $10,000.

MARATHON, N. Y.—Surveys are being made by Mr. Clark, of Kingston, for a system, according to reports.

NEW YORK, N. Y.—Bids are asked by the commissioner of street improvements, 2622 Third Ave., until June 4, for constructing sewers in nine streets.

PORT RICHMOND, N. Y.—Bids will soon be asked for constructing a sewer from Prohibition Park through Jewett Ave. to an outlet in Richmond Ave., plans for which are said to be in the commissioners' hands. Engr., C. T. Barrett.

ROCHESTER, N. Y.—It is proposed to construct 20 to 12-in. pipe sewers in three streets, estimated to cost $50,000. T. S. Pulver, Cy. Clk.

SYRACUSE, N. Y.—Bids are asked until May 27 for constructing a 12-in. pipe sewer in Brook St. and 36 to 30-in. brick sewers in two streets. H. F. Stephens, Cy. Clk.

NEWARK, N. J.—Bids were asked in local papers until May 23 for constructing sewers. About $500,000 worth of sewer work will probably be placed under contract this summer, but each piece of work is not definitely decided upon until the Thursday night previous to the Thursday upon which the bids are to be opened. This is evidently intended to prevent outside competition. For particulars address the board of public works.

TRENTON, N. J.—Plans have been prepared for sewers in the eastern part of the city. Consult. Engr., Rudolph Hering, New York.

CHESTER, PA.—The construction of a sewer in Hayes St., in South Chester, is being considered by the board of health.

EBENSBURG, PA.—It is reported that the council is considering the construction of a system.

EMPORIUM, PA.—Bids are asked until June 15 for constructing a sewer, as stated in our advertising columns. C. W. Shaffer, Borough Secy.

LANSDALE, PA.—Bids are asked until May 27 for constructing a sewer. S. D. Lehr, of Allentown, is interested.

YORK, PA.—The council is reported as proposing to issue about $32,000 in bonds for sewers in four streets.

BALTIMORE, MD.—The committee on highways has voted favorably on an ordinance appropriating $50,000 for a sewer in four streets.

WASHINGTON, D. C.—Bids are asked by the district commissioners until June 3 for constructing sewers.

MANCHESTER, VA.—Edwin Mitchell, Engr., writes us that Z. T. Darrow, of Marietta, O., has been awarded the contract for constructing sewers, at $28,905, as advertised in Engineering News. The itemized bids were published May. 9.

ATLANTA, GA.—An election will be held May 26 to vote on the question of issuing $150,000 in bonds for extending sewers and water mains, constructing two garbage crematories, etc.

INDIANAPOLIS, IND.—Resolutions have been passed for constructing a sewer about 2,000 ft. in length, the contract to be awarded about June 5. Plans have been ordered for local sewers in a number of streets. Chas. C. Brown, Cy. Engr.

DETROIT, MICH.—The council has for the second time rejected the bids for constructing lateral sewers, and will ask for new bids.

CHICAGO, ILL.—Bids are asked until May 29 for furnishing cast iron manhole and catchbasin covers for one year. W. D. Kent, Comr. Pub. Wks.

FARIBAULT, MINN.—It is reported that the city has advertised for bids for constructing a system.

JANESVILLE, WIS.—C. F. Loweth, of St. Paul, has prepared plans for a system on Quality Hill. A. E. Rich, W. H. Greenman and C. S. Jackman have been appointed a committee to consider the plans.

FRESNO, CAL.—J. W. Shanklin, Cy. Clk., writes us that 5% bonds were voted May 4 for constructing 48,000 ft. of 14 to 8-in. pipe sewers, average cut 14 to 5 ft., estimated to cost $40,000, work to be commenced by Aug. 1. Engr., J. C. Shepard; Louis Manuel, Cy. Engr.

GARBAGE DISPOSAL.

ALBANY, N. Y.—The council and board of health are reported as continuing to discuss the question of garbage disposal and the erection of a garbage crematory. The legislature of 1894 passed a bill permitting the board of health to spend a sum not to exceed $30,000 for this purpose.

GLOVERSVILLE, N. Y.—Bids are asked until May 28 for the collection of garbage, according to reports.

UTICA, N. Y.—The contract with the American Reduction Co. for the construction of a garbage crematory in this city is reported to have been forwarded to the company for its signature.

POTTSVILLE, PA.—The board of health has recommended the purchase of a crematory to burn the garbage of the city, according to press reports.

CHILLICOTHE, O.—The board of health has voted to select a sandy place and bury the garbage of the city. There is also talk of burning it.

CHICAGO, ILL.—Alderman Finkler, Chn. Council Com. on Health, has prepared an ordinance providing for the cremation of all animal and vegetable refuse, and another making it a felony to dump garbage within the city limits.

STREETS AND ROADS.

PORTSMOUTH, N. H.—The mayor has recommended that some of the macadamized streets be reconstructed, and that a certain amount be appropriated each year for macadamizing.

BOSTON, MASS.—Bids are asked until May 29 for 1,450 sq. yds. of granite block paving on gravel base, etc. B. T. Wheeler Supt. St.

BOSTON, MASS.—Bids are asked until May 31 for the purchase of $400,000 of 3½% highway bonds. E. P. Shaw, Treas.

FALL RIVER, MASS.—The construction committee has recommended the paving of Pleasant and South Main Sts., which will require about 135,000 blocks.

NEWTON, MASS.—Bids are asked until May 24 for the purchase of $132,000 of 40-year 4% highway and boulevard bonds.

ALBANY, N. Y.—It is reported that bids will soon be asked by the Albany Road Improvement Association for constructing a portion of the speedway. Treas., Edward Bronk.

AUBURN, N. Y.—D. F. Austin, Cy. Surv., writes us that the city proposes to construct 6,300 sq. yds. of sandstone paving.

BROOKLYN, N. Y.—It is reported that the commissioner of city works estimates that a million dollar's worth of paving and repaving will be done this season, $400,000 worth of which will be asphalt, and another large portion is to be brick paving.

BUFFALO, N. Y.—Front Ave. is to be paved with asphalt from Court St. to Porter Ave., Geo. H. Selkirk, Secy. Bd. Park Comrs.—The board of public works has received the following bids for paving Ashley St. from the Junction railroad to Deshler St. with asphalt: The Barber Asphalt Paving Co., $26,708; the German Rock Asphalt Co., $27,200; Pliny B. McNaughton, $21,997 for brick.

ITHACA, N. Y.—Bids are asked until June 11 for 15,000 sq. yds of brick paving, as stated in our advertising columns. H. A. St. John, Supt. Pavement Comm.

NEW YORK, N. Y.—Bids are asked by the commissioner of street improvements, 2622 Third Ave., until June 4 for grading, etc., portions of four streets.

NEW YORK, N. Y.—Bids are asked by the department of docks until May 28 for 2,365 sq. yds. of Belgian block paving, etc., on West 52d and West 54th Sts.

ROCHESTER, N. Y.—It is proposed to pave South Ave. with Medina standstone, estimated to cost $44,500, and construct cement sidewalks in West Main St., estimated to cost $13,000. T. S. Pulver, Cy. Clk.

STAPLETON, N. Y.—We are informed the county will advertise for bids for about ten miles of new macadam and macadem renewal road work in the early or middle part of next month. Engr., Henry P. Morrison.

SYRACUSE, N. Y.—Bids are asked until May 27 for sheet asphalt paving on West Fayette St., and constructing asphalt or cement crosswalks in 15 streets. H. F. Stephens, Cy. Clk.

TOTTENVILLE, N. Y.—We are informed that in consequence of legal difficulties it is probable that the expenditure of the $40,000 voted at the last spring election by the citizens of Westfield township for macadamizing the roads will be somewhat delayed. Abram Cole, Chn. Bd. Supervisors.

UTICA, N. Y.—Bids are asked until May 24 for sheet asphalt paving on two streets, and for constructing sandstone and other sidewalks in nine streets. J. A. Cantwell, Cy. Clk.

WHITE PLAINS, N. Y.—The village has been authorized to spend $50,000 for street paving. It is reported that brick paving is being considered by the committee.

BELLEVILLE, N. J.—The town voted May 16 to issue $65,000 in bonds for macadamizing a number of roads, work on which will begin as soon as the bonds are sold.

CAMDEN, N. J.—The council has been petitioned by James A. Delany and others to pave a portion of Sixth St. with granite blocks. L. E. Farnham, Cy. Engr.

NEWARK, N. J.—This city is planning to contract for $1,000,000 worth of paving, but it is not probable that steps will be taken to secure bids from any except local contractors, as the bids will be opened on the Thursday following the Thursday upon which it is voted to advertise for bids. Address the board of public works.—The board of public works has voted to pave Summer Ave., from Bloomfield to Chester Ave., and Sherman Ave. from Parkhurst St. to Pointer St., with asphalt, and Eighth Ave. from Spring St. to Summer Ave. with granite blocks.

ALLEGHENY, PA.—Bids are asked until May 27 for repaving portions of 13 streets and about 3,000 sq. yds of resurfacing park walks. Robt. McAfee, Dir. Pub. Wks.

ALLEGHENY, PA.—The public works committee has recommended that portions of 24 streets be repaved.

PITTSBURG, PA.—Bids are asked until May 25 for 5,000 cu. yds. of filling at Bates and Wilmot Sts. E. M. Bigelow, Dir. Dept. Pub. Wks.

WILMERDING, PA.—The council has been petitioned to appropriate from $30,000 to $50,000 for paving five streets.

WILMINGTON, DEL.—Ordinances have been introduced in the council for issuing $225,000 in bonds for improvements.

ANNAPOLIS, MD.—It is reported that all bids received by the U. S. government for paving Hanover, King George and Wagner Sts. have been rejected. It is said other arrangements will be made satisfactory to the city.

LAUREL, MD.—John W. Gray, Clk., writes us that bids will probably be received between June 1 and June 5 for macadamizing Main St. for a distance of over a mile and constructing brick sidewalks on the same street.

SISTERSVILLE, W. VA.—Bids are asked until May 25 for 2,000 yds. of grading, 4,800 yds. of brick paving and 2,500 ft. of curbing. Geo. E. Work, Recdr.

ATHENS, O.—Bids are asked until June 3 for improving several roads in Athens county. A. J. Frame, County Audr.

AVONDALE, O.—Bids are asked until May 31 for constructing cement sidewalks in two streets, and until June 15 for improving one street. W. E. Wynne, Clk.

CLEVELAND, O.—Bids are asked by the board of park commissioners until May 29 for 20,500 sq. yds. of Telford macadam paving on the east high level drive of the Doan Brook Parkway. C. W. Pratt, Jr., Ch. Engr., Hickox Bldg.

COLUMBUS, O.—Bids are asked until June 4 for grading, macadamizing and constructing pavements on five streets. J. A. Fanning, Clk. Bd. Pub. Wks.

WASHINGTON, IND.—It is reported that 27 squares are to be paved with brick.

INDIANAPOLIS, IND.—Bids are asked until May 28 for about 9,800 sq. yds. of brick paving, 2,500 sq. yds. broken stone, about 5,500 lin. ft. of cement sidewalks, etc., and until June 1 for constructing 3,000 lin. ft. of cement sidewalks.——Resolutions have been passed for 6,400 lin. ft. of asphalt paving, 2,000 ft. brick sidewalks and about 10,000 ft. of cement sidewalks, all of which contracts will be awarded about June 15 to 20. Chas. C. Brown, Cy. Engr.

QUINCY, ILL.—The board of public works has been directed to advertise for bids for 52,272 sq. yds. of brick paving, about 21,000 ft. of curbing, etc., estimated to cost $35,805.

MILWAUKEE, WIS.—Geo. H. Benzenberg, Cy. Engr., is preparing specifications for paving a number of streets with brick and asphalt, and it is reported that bids will be asked as soon as the specifications are ready.

FARGO, N. DAK.—Property owners on Broadway are preparing to pave a portion of that street with cedar blocks. Alexander Stern is interested.

SEDALIA, MO.—The council has voted to pave Seventh St. with asphalt and Fourth St. with a material not yet determined upon.

OMAHA, NEB.—Bids are asked until June 10 for the purchase of $172,000 of 5% paving bonds. Henry Bollen, Cy. Treas.

DENVER, COLO.—Press reports state that County Commissioners Baxter, Swan and Brown and County Clerk Abbott, of Larimer county, have had a conference with State Engineer Sumner relative to the building of a new road from Bellevue to Steamboat Springs. The road will be about 125 miles in length and will cost $15,000, which amount was appropriated by the last legislature for this purpose.

PORTLAND, ORE.—The city surveyor is preparing plans for improving East 11th St.

CONTRACT PRICES.

VALVE BOXES AND CAP STONES.—Syracuse, N. Y.—W. R. Hill, Ch. Engr. and Supt., writes us that the contract for 600 valve boxes has been awarded to Jackson & Woodin Mfg. Co., Berwick, Pa., at 1.6 cts. per lb. delivered in Syracuse, and that for gray lime cap stones to John Crabtree, of Syracuse, at $2.24 each.

BRICK PAVING.—Wilkes Barre, Pa.—I. M. Kirkendall, Chn. Com., writes us that the contract for paving Water and North Sts. with one course of brick upon concrete foundation has been awarded to the Buffalo Construction Co., at $1.89 per sq. yd.

STREET CLEANING.—Buffalo, N. Y.—Bids for street cleaning after June 1 have been received, the prices for the eight districts into which the city is divided ranging as follows, for each 10,000 sq. yds. of surface: Stone streets, 49 to 75 cts.; asphalt, 27 to 52 cts.

RETAINING WALL.—Harrisburg, Pa.—The contract for building a retaining wall on Conestoga St., near Second St., has been awarded to John Sheaffer, at $2.15 a perch, the contractor to furnish all materials.

BRIDGE MASONRY.—Bridgeport, Conn.—The board of public works has awarded the contract for the construction of the masonwork of the new bridge on North Ave. over the Pequonnock River to E. J. Casey, at $2.16 per cu. yd., the city to furnish the stone.

BRICK PAVING.—Carbondale, Pa.—Bids for paving with brick on concrete, as advertised in Engineering News, were received May 13 on about 15 varieties of brick, the bids ranging from $1.60 to $2.60 per sq. yd. It is stated that the work offered at $1.93 was the same that cost $2.10 on Main St., and $2.52 on Dundaff St. Walter Frick, Cy. Engr.

WATER-WORKS.—Macungie, Pa.—The awarding of the contract for works to O'Reilly & Nolan was noted last week under Water-Works. L. J. H. Grossart, Engr., Allentown, writes us that the bids were as follows:

Items.	Lehigh Valley Coast'n Co.	Schweyer & Deitle.	O'Reilly & Nolan.	Seibert & Haffner.	George W. Schwartz.	Mickley & Chance.	Neumoyer & Markley.	Yarnell & Son.
Excavation:								
Earth	$0.40	$0.25	$0.24½	$0.22	.....	$0.25	.....	$0.54
Rock	1.00	.75	1.25	.....	$0.38	.98	$0.50	.....
Slope	.30	.30	.20	.35	.....	.25	.....	.62
Masonry	4.00	4.50	2.00	4.25	.....	5.25	.....	3.52
Concrete	4.50	5.75	4.00	5.00	.....	5.75	.....	5.72
Stone gutter	.40	.10	.04½	.13	.....	.10	.....	.08
Pipe overflow	.28	.30	.10	.25	.....	.10	.....	.50
Laying pipe:								
8-in.	.24	.30	.14	.30	.24½	.59	.30	.33
6-in.	.16	.30	.14	.30	.18	.16	.15	.18
4-in.	.20	.25	.14	.30	.18	.25	.15	.16
Set'g fire hyds	7.00	5.00	.80	9.50	.34	5.85	.84	1.50

PUMPING ENGINE.—Haverhill, Mass.—Jas. A. Huntington, Secy. Comrs., writes us that the water commissioners have contracted with Henry R. Worthington, of New York, for a new horizontal, triple-expansion, high-duty pumping engine, at a cost of $20,900; capacity per 24 hours, 8,000,000 gallons; guaranteed duty, 125,000,000; on test of 12 hours, 100,000,000.

STONE.—Pittsburg, Pa.—The following bids were received by Maj. R. L. Hoxie, U. S. Engineer Office, May 11, for 284 cu. yds. of stone for lock in Allegheny River: Jutte & Foley, Pittsburg, $10 per cu. yd.; Driver & Panson, Beaver, Pa., $9.48; Patton & Gibson, Beaver, Pa., $6.42; Jos. Gianini, Allegheny, $6.50; Lawrence T. Wilson, Ellwood City, Pa., $8.89.

SEWERS.—Albany, N. Y.—The contract for building the Beaver Creek sewer from Lexington Ave. to Partridge St. has been awarded to Robt. H. Strong, as noted last week under Sewerage. The bids were as follows:

Bids Received for Constructing Beaver Creek Sewer, at Albany, N. Y.

Quantities.	R. H. Strong, Albany.	John Smith, New York.	T. H. Dunnary, Albany.	Troy Public Works Co., Troy.	W. J. McCann, Albany.	W. M. Dunn, Albany.	M. J. Daly, Brooklyn.	P. Callanan, So. Bethlehem, N. Y.
7 ft. 0 ins. sewer, trench or embankment, 3,770 lin. ft.	$3.40	$4.99	$4.90	$5.20	$6.88	$6.90	$6.00	$7.50
5 " 9 " " " " " " 157 " "	3.40	4.26	1.45	5.20	2.49	2.85	5.00	4.00
4 " 9 " " " " " " 818 " "	3.40	3.43	1.00	5.20	2.50	2.65	4.00	6.00
2 " 6 " " " " " " 515 " "	2.40	2.34	2.73	5.20	2.00	1.80	3.80	4.50
Concrete, 77 cu. yds.	5.00	5.90	6.00	6.00	5.90	6.00	7.00	6.00
Brick masonry (common) 3,570 " "	8.21	7.50	8.37	8.00	8.00	8.00	7.00	9.50
Vitrified paving brick masonry 664 " "	14.02	13.18	16.30	14.00	12.00	12.00	15.50	15.75
Rubblestone masonry, 675 " "	5.50	6.00	4.80	6.00	6.00	6.00	6.50	6.00
Lumber, spruce or hemlock, 58.5 M. ft.	12.00	20.00	13.50	30.00	14.00	14.75	25.00	16.00
Iron 6,200 lbs.	.02½	.02¼	.04	.05	.03	.03	.08	.03½
15-in. vitrified pipe, 375 lin. ft.	2.00	3.12	3.70	1.00	1.95	1.50	2.80	2.00
20-in. " " extra heavy 172 " "	2.50	4.05	2.50	5.00	5.00	5.00	2.80	2.50
6-in. " " 3,000 " "	.23	.21	.14	.20	.25	.25	2.25	.12
15-in. Y-branches 12	4.25	2.12	2.00	1.50	5.00	5.00	3.94	4.50
Total	$62,863	$67,354	$68,690	$73,638	$73,842	$73,877	$79,130	$87,760

ASPHALT PAVING.—Indianapolis, Ind.—Contract for asphalting Indiana Ave. was let to the Western Paving & Supply Co., at $7.31 per lin. ft. of each side of the street, other bids being the Indiana Bermudez Co., at $7.45, and the Warren-Scharf Co., at $7.75. The work includes 15,535 sq. yds. of asphalt on 6 ins. Portland cement concrete, 4,319 ft. of stratified limestone curb, 682 ft. of granite round-corner curb, 6,811 ft. of limestone marginal finish, one manhole, six catchbasins, 25 inlets.

MACADAMIZING.—Kansas City, Mo.—The following bids were received by F. J. O'Flaherty, County Surv., for macadamizing the Croysdale road: Carr & Yitter, Independence, Mo., $1.03 per cu. yd., total $13,260; J. E. Farris, Kansas City, Mo., 97 cts., $9,804; Kansas City Construction Co., Kansas City, Mo., 87½ cts., $8,900; D. B. Morrison & Co., 94 cts., $9,588; W. L. Lewis, 93 cts., $9,486; Colyer Bros., Independence, Mo., $1, $10,200; John Mahoney, Kansas City, Kan., $1.15, $13,800.

SEWERS.—Milwaukee, Wis.—G. H. Benzenberg, Cy. Engr., writes us that the following bids were received last week for constructing about 1,000 ft. of 10-ft. sewer, largely in tunnel; all bidders residents of Milwaukee:

	Per lin. ft.
O'Connor & O'Neil	$45.00
Henry Vogt	23.97
Morrissey & Ryan	26.77
James O'Donnell	29.00
James Markey	26.00
Robert Chambers	34.00
M. Davelaar	32.00
E. Bowler	28.90
J. J. Crilley (awarded contract)	22.69

SEWERS.—Williamsport, Pa.—The contract for constructing sewers, as advertised in Engineering News, was awarded on May 9 to Berry & Day, at $9,129, as noted last week under Sewerage. Geo. D. Snyder, Cy. Engr., informs us that the itemized bids were as follows:

Bids Received at Williamsport, Pa., May 9, for Constructing Pipe Sewers.

Quantities.	Berry & Day, Bellaire, O.	D. P. Geise, Williamsport, Pa.	Ward & Stucker, Harrisburg, Pa.	J. McCloud & Co., Williamsport, Pa.	T. McGuigan, Meadville, Pa.	A. H. Coan & Son, Kingston, Pa.	Sowders & Houston, Pittsburg.	Dodge & MacGregor, Buffalo, N. Y.	Bowman Bros., McKeesport, Pa.
24-in. pipe 2,920 ft.	$1.40	$1.40	$1.36	$1.48	$1.34	$1.60	$1.55	$1.55	$2.35
20-in. " 805 "	1.20	1.26	1.40	1.38	1.50	1.40	1.43½	1.11	2.00
12-in. " 1,725 "	.52	.54	.47	.47	.51	.50	.60¾	.68	.95
10-in. " 2,825 "	.44	.47	.75	.25	.50	.41	.54	.50	.60
8-in. " 4,090 "	.38	.40	.35	.33	.43	.35	.37	.43	.48
24 x 6-in. Y's 211	4.20	2.20	3.08	2.25	2.22	3.00	2.67	2.45	2.35
20 x 6-in. " 42	4.00	2.10	2.07	4.00	2.10	2.14	2.18	1.73	2.00
12 x 6-in. " 74	1.24	.60	.59	.65	.56	.60	.65	.72	.65
10 x 6-in. " 164	.94	.46	.44	.48	.46	.45	.50	.58	.60
8 x 6-in. " 292	.66	.33	.29	.40	.32	.32	.37	.43	.48
6-in. house connections	.....	.25	.45	.55	.50	.45	.55	.40	.40
Manholes 22	30.00	28.00	30.00	27.00	30.00	30.00	33.00	35.00	55.00
Lampholes 1	10.00	5.00	8.00	6.00	5.00	9.00	4.75	7.00	10.00
Flushtanks 1	50.00	6.00	45.00	80.00	40.00	70.00	57.00	85.00	150.00
Concrete, per cu. yd.	4.50	6.00	6.00	5.50	4.00	5.00	4.60	5.00	5.00
Extra brick work, per M.	12.00	18.00	13.00	17.00	12.50	14.00	14.50	15.00	10.00
4-in. drain tile laid, per ft.	.35	.08	.15	.10	.10	.30	.09	.09	.07
Total	$10,585	$9,906	$9,737	$9,906	$10,171	$10,519	$10,887	$10,940	$14,902
Lump bid	9,129	9,524	9,737	.....	10,171	10,519	.....	.....	.....

DREDGING.—Philadelphia, Pa.—The following bids were received by Maj. C. W. Raymond, U. S. Engineer Office, May 16, for dredging through Porriwig Bar, in the Delaware River, about three miles below Trenton: American Dredging Co., 14 cts. per cu. yd.; F. C. Somers, 24 cts.

WELL.—San Antonio, Tex.—The only bid received by Maj. G. C. Smith, Q. M., U. S. A., for boring a well at Fort Ringgold was that of Oscar Staben & C. G. Peters, of Laredo, Tex., at $7.50 per ft. for the first 200 ft., with 8-in. pipe, and $6 per ft. for 6-in. pipe down to 400 ft.

PAVING BRICK.—Washington, D. C.—The following bids were received by the district commissioners last week for furnishing paving brick for the next fiscal year: Washington Brick & Terra Cotta Co., $7.50 per M. at place of work, and $7.90 delivered at District of Columbia property yard; Virginia Paving & Construction Co., Lynchburg, vitrified brick at $17.25 per M.; Frederick Brick Works, paving brick, $9.50; John Roebrecht, vitrified brick at $22.45; John M. Mack, vitrified brick at $21.65; Francis & Rouf, vitrified brick at $16.45; Harris Brothers & Lane, vitrified brick at $21.50; Charles Ford, paving brick at $8.

STAND-PIPE.—Schenectady, N. Y.—The following bids were received May 9 for the construction of a steel stand-pipe, 32 x 100 ft., as advertised in Engineering News; Engrs., the Stanwix Engineering Co., Rome, N. Y.; Secy. Comrs., Geo. D. Bradt:

*Ranton Boiler Co., Syracuse, N. Y.	$8,335
**Elmira Machine Co., Elmira, N. Y.	9,100
Riter & Conley, Pittsburg, Pa.	9,638
Enterprise Boiler Co., Youngstown, Ohio.	10,904
***Tippett & Wood, Phillipsburg, N. J.	9,045

* Contract awarded to Ranton Boiler Co.
** Informal, no check with bid.
*** Informal, bid based on wrought iron.

SEWERS.—Indianapolis, Ind.—Contract for local sewer in alleys east and west of Mississippi St., etc., has been let to D. De Ruiter, at $1.79 cts. per lin. ft. Other bids were $2.08 and $2.43. The work includes 1,787 ft. of 32 by 48-in. two-ring brick sewer, 452 ft. of 24 x 36-in. two-ring brick, 1,748 ft. of 20 x 30-in. one-ring brick, 390 ft. of 18 x 27-in. one-ring brick, 440 ft. of 18-in. pipe, 1,030 ft. of 15-in., 380 ft. of 12-in., 1,572 ft. of 10-in., 490 ft. of 8-in., 1,770 ft. of 6-in. house connections, 27 catchbasins, 36 manholes, five lampholes, two flushtanks, 17 additional Y-branches, 385 ft. of 12-in. lateral connections and 1,158 ft. of 15-in. lateral connections, the total measured length of sewer to be paid for being 8,298 ft.

LEVEE WORK.—Rock Island, Ill.—The following bids were received by Lieut.-Col. A. Mackenzie, U. S. Engineer Office, May 14, for enlargement and repair of levees in Mississippi River, between Warsaw and Quincy, Ill., as advertised in Engineering News; the bids being (1) the price per cubic yard for 300,000 cu. yds. of earthwork in Hunt and Lima Lake district, and (2) for 300,000 cu. yds. of earthwork in Indian Grave district:

	1. cts.	2. cts.
McManus & Joyce, Keokuk, Ia.	10.95	13.75
John Breheney & Sons, Keokuk, Ia.	13.00	14.00
T. S. Aderholdt, Friars Point, Miss.	12.74	12.44
Casgrain & McDonald, Chicago, Ill.	8.95	10.95
R. M. Quigley & Co., St. Louis, Mo.	12.22	12.22
Martin Jennings, Memphis, Tenn.	12.19	12.89
Kelly & Monroe, Portsmouth, Ohio.	13.50	13.50
Ed. Phelan, Omaha, Neb.	11.50	11.50
R. H. McWilliams & Co., Chicago, Ill.	13.75	13.75
Samuel Katz, Omaha, Neb.	10.50	13.00
Thompson & Gray, St. Louis, Mo.	18.00	19.50
Jones & Strickler, Keokuk, Iowa	13.87	.....
S. A. Harrison & Co., Milwaukee, Wis.	15.00	.....
J. A. Ware, St. Louis, Mo.	9.19	13.3-7
John J. McCaughey, Summit, Ill.	11.48	14.75
M. H. King & Co., Des Moines, Ia.	9.75	10.50
Mallory, Cushing & Co., Omaha, Neb.	12.45	13.45
N. P. Glann Constn. Co., Galesburg, Ill.	14.00	15.60
A. J. Whitney, Rock Island, Ill.	22.50	22.50
Penney-Myers Constn. Co., St. Louis, Mo.	9.87	11.87
Patrick McDonell, Duluth, Minn.	9.75	11.50
Henry Hall, Florence, Neb.	11.23	.....
C. H. Dameron & Bro., Huntsville, Mo.	14.00	16.50

MISCELLANEOUS CONTRACTS AND SUPPLIES.

STREET ROLLER.—York, Pa.—The new loan bill contains an appropriation of $3,500 for the purchase of a street roller.

CEMENT.—Pittsburg, Pa.—Bids are asked until May 25 for about 2,000 bbls. of cement. Jas. A. Grier, County Controller.

BOILER.—Newark, N. J.—Bids are asked until May 31 for a new 80-HP. boiler for the city hospital. D. L. Wallace, Chn. Com.

FENCE.—Salt Lake City, Utah.—Bids are asked until June 1 for the construction of about 6,000 lin. ft. of fence. A. F. Doremus, Chn. Bd. Pub. Wks.

DAM.—Shelburne Falls, Mass.—The contract for building a new dam for the Lamson & Goodnow Mfg. Co. has been awarded to Thos. Kennedy, of Smiths Ferry.

SMOKE PREVENTING DEVICE.—Rockford, Ill.—Bids are asked until June 6 for a smoke preventing device, as stated in our advertising columns. Chas. C. Stowell, Supt. W. W.

LEVEE WORK.—Memphis, Tenn.—Bids are asked until May 28 for constructing about 600,000 cu. yds. of levees in Upper Tensas district. Capt. C. McD. Townsend, U. S. Engr. Office.

DREDGING.—Philadelphia, Pa.—The bureau of surveys is reported as preparing specifications for dredging in the Delaware and Schuylkill rivers, for which $225,000 has been appropriated.

BRICK-MAKING PLANT.—Lewiston, N. Y.—Jewett, Reynolds & Purcell are reported as preparing to build a large brick-making plant, to cover 30 acres of ground, at Model City, near this place.

FENCE.—Columbus, O.—Bids are asked until June 20 for the construction of 640 ft. of solid fence and 3,000 ft. of open iron fence on the Leonard Ave. viaduct and approaches. Wm. H. Halliday, County Audr.

BOILERS.—Boston, Mass.—Bids are asked by the metropolitan sewerage commissioners until May 25 for building and erecting two vertical boilers, 48 × 150 ins., at the Alewife Brook pumping station, West Somerville.

STEAM BOILER PLANT.—Chicago, Ill.—Bids are asked until June 10 by the directors of the Chicago public library for furnishing and setting four water-tube boilers, with aggregate heating surface of 7,875 sq. ft. W. B. Wickersham, Secy.

WHARF REPAIRS.—Philadelphia, Pa.—The following bids were received for repairing the city's wharf at Fairmount Ave., Delaware River: J. R. Hathaway & Co., $6,217; Eyre & Nevelin, $4,950; J. A. Mundy & Bro., $4,500; Joseph J. Allen, $2,943.

DAM WORK.—Oswego, N. Y.—The Donnelley Contracting Co., of Buffalo, has been awarded the contract for putting a new apron to the first dam in the Oswego River. It is stated that the work will be commenced about July 1, and will cost about $27,000.

NEW CHANNEL.—Duluth, Minn.—The aldermen are considering plans for a new channel to Howard's Pocket. The work would require about 55,000 cu. yds. of dredging refuse from saw mills and 7,000 cu. yds. of earth dredging. The improvement is estimated to cost about $38,000.

DIKE WORK.—Corning, N. Y.—An appropriation of $150,000 was recently voted for building a dike along the Chemung River. Gen. Palmer C. Ricketts, of Troy, who prepared plans for the work about two years ago, and H. C. Heermans, Cy. Engr., have been appointed a committee to confer with an expert in New York with regard to the plans and specifications.

INDUSTRIAL NOTES.

THE PENNSYLVANIA STEEL CO., of Steelton, Pa., is erecting a new rolling mill 214 × 81 ft.

THE STANDARD SEWER PIPE CO., of Huntingdon, Pa., has enlarged the capacity of its plant.

THE GOFF STEEL CO., of Mendelsshon, Pa., will erect a tin mill in connection with its steel works.

THE ROGERS LOCOMOTIVE WORKS, of Paterson, N. J., has an order for four locomotives for the Chilean Government railways.

THE MADISON CAR CO., of Madison, Ill., is building 12 side-dump cars, 36 ft long, of 60,000 lbs. capacity, for the Texas & Pacific Coal Co.

THE FRED. M. PRESCOTT STEAM PUMP CO., of Milwaukee, Wis., has the contract for two pumping engines to run the elevators in the new city hall.

THE FOREST CITY CAR & MFG. CO., of Montrose, Pa., has an order for 300 Gallagher oilers for mine cars on the New York, Lake Erie & Western R. R.

HENRY R. WORTHINGTON, of New York, N. Y., has the contract for pumping engines of 40,000,000 gallons daily capacity for the water supply and electric fountains of the Cotton States & International Exhibition at Atlanta, Ga.

LESTER E. WOOD, 53 State St., Boston, Mass., has been appointed Eastern sales-agent for cast iron water and gas pipe, for the Anniston Pipe & Foundry Co., of Anniston, Ala., and the Chattanooga Foundry & Pipe Works, of Chattanooga, Tenn.

THE UNITED STATES WIND ENGINE & PUMP CO., of Batavia, Ill., has been awarded a contract for building a complete system of water-works at Williams, Ia. The company reports an increased demand for its Halliday wind mills, and a general improvement in its business.

THE MORISON-JEWELL FILTRATION CO., of New York, N. Y., has a contract from the Cataract Construction Co., of Niagara Falls, N. Y., for a gravity filtration plant to have a daily capacity of 4,500,000 gallons. The auxiliary pumps to be used in connection with this plant are to be operated by electric motors.

JEWETT & REYNOLDS, of Buffalo, N. Y., have a contract for 2,000,000 common brick for use in the foundation and inside walls of the Ellicott Square Building, in Buffalo, at their bid of about $12,500. The same firm has also been awarded a contract for furnishing 1,500,000 solid and 500,000 hollow brick for the new Guaranty Building, for about $13,500.

THE BERLIN IRON BRIDGE CO., of East Berlin, Conn., has completed the steel frame for the extension to Gardes Hotel, New Haven, Conn., and the new boiler house for the Piercefield Paper & Mining Co., at Piercefield Falls, N. Y. It is now putting up a new car barn, 73 × 223 ft., for the Wilkes Barre & Wyoming Valley Traction Co., at Wilkes Barre.

THE YOUNGSTOWN BRIDGE CO., of Youngstown, O., has been awarded the bridge work to be built by the Cleveland, Akron & Columbus Ry., consisting of two 91-ft. girder spans on bents across Big Walnut Creek, two 144-ft. spans near Gambier, and three 108-ft. spans over Mohican River. These bridges are designed for 120-ton consolidation engines and are to be of steel throughout.

B. J. ARNOLD, Consulting Engineer, has removed his office to 1541 Marquette Building, Chicago, Ill. He has recently been engaged as consulting engineer by the Board of Trade of Chicago, for the complete remodeling of its entire power and electric lighting plant. He is consulting engineer for the St. Charles St. Ry. Co., of New Orleans, and is finishing a complete electric lighting plant for Fort Dodge, Ia., and the reconstruction of the electric railway for Freeport, Ill.

THE CANADIAN BRIDGE CO., of Montreal, Que., is reported as having secured the contract for all bridge work on the Chaudiere Junction & Yamaska section of the Atlantic & Lake Superior Ry. The bridges include one over the St. Francis between St. Francois du Lac and Pierreville of 1,900 ft. in length with an average span of 120 ft. and a height above river bottom of 60 ft.; a deck bridge at Nicolet, over the Nicolet River, 600 ft. long, and 120-ft. span, with facilities for vehicle traffic; and also one at Becancour which measures with approaches some 1,300 ft. Besides these, there are several of lesser importance, of which the principal are those across the Gentilly River, River du Chene and the Chaudiere River.

JOHN A. ROEBLING'S SONS CO., of Trenton, N. J., states that it has secured two contracts of great importance. The Pennsylvania R. R. proposes to equip the Mount Holly branch with electricity and has ordered from the company the 00 B. & S. gage hard-drawn copper trolley wire, and 500,000 circular mills standard triple braid weatherproof feeder wire for the overhead construction. This line is about eight miles long and has been operated by steam locomotives. The New York, New Haven & Hartford R. R. is also making a trial of electric traction on the Nantasket Beach branch. The feeder wire will be stranded high conductivity copper wire. The trolley wire, however, is of a novel construction, formed like a squash in cross-section with the lower bulb considerably larger and flattened on its under surface so as to give a large contact to the trolley. The difficulties in the manufacture of this peculiar shape are considerable, but the Roebling company's plant is equipped for all manner of special work of this kind.

THE MARYLAND STEEL CO., of Sparrows Point, Md., had its entire property offered for sale at public auction May 15, at the Philadelphia Exchange, Philadelphia, Pa. The property was bought in by Effingham B. Morris, on behalf of the reorganization committee, of which he is chairman, for $2,000,000, the amount of the bonded indebtedness. He was the only bidder. Application will be made to the State Department at Harrisburg for a new charter for the Pennsylvania Steel Co., which owns the stock of the Maryland Steel Co., and when this has been secured and other matters pertaining to the reorganization arranged, the concern will be taken out of the receiver's hands. It is reported that the receivers will probably be discharged in about 60 days. The stockholders of the old company have subscribed $1,500,000 in cash for preferred stock in the new company, and creditors with claims aggregating $5,300,000 will be paid at the rate of 40% in cash and the balance in consolidated bonds of the Pennsylvania Steel Co. and the Maryland Steel Co.

FRASER & CHALMERS, of Chicago, Ill., have had several orders recently for Riedler pumping engines and report the use of this machine to be increasing in America and in foreign countries. Among the engines recently sold is a 12 × 19 × 16-in. cross-compound non-condensing slide-valve engine, actuating a pair of 7 × 16-in. Riedler duplex pumps, for the Pennsylvania R. R. At 95 revolutions the capacity is 500 gallons against 600 ft. head, but the speed may be increased to 142½ revolutions, with a corresponding increase in capacity. An engineering arrangement of less usual character is exhibited in the Riedler air-compressing pneumatic and pumping machinery recently ordered by the Delaware, Lackawanna & Western R. R. This will comprise, first, a 17 and 28 × 24-in. cross-compound condensing Corliss engine, actuating a 14 & 23¼ × 24-in. compound air compressor. The capacity at 110 revolutions will be 1,150 cu. ft. of air per minute, steam pressure (initial) 100 lbs., air pressure 110 lbs. The air pressure will be transmitted about 3,800 ft (3,000 horizontally, 800 vertically), and will actuate, with a guaranteed efficiency of 90%, a compound pneumatic engine 15 & 21½ × 18 ins., which in turn will drive two 5½ & 5⅝ × 18-in. differential pumps. These, at 120 revolutions, will lift 700 gallons a minute against a head of 770 ft.

NEW COMPANIES.—Finished Steel Co., Youngstown, O.; $100,000; steel bars, tubes, shafting, etc.: John E. McVey, C. Seymour Dutton, and Philip M. Haas.

St. Louis Asphalt & Paving Co., East St. Louis, Ill.; $10,000; Griffith Colt, M. Kraemer and J. E. Weber.

Pittsburg Gas, Fuel & Chemical Co., Pittsburg, Pa.; $1,000; manufacturing gas and fuel from coal, etc.; Treas., Samuel Woods.

Columbian Talc Co., Gouverneur, N. Y.; $50,000; Wm. R. Caulder and Charles H. Little, of Detroit, Mich.; Orrin J. David, Gouverneur, N. Y.

Bissell, Dodge & Erner Co., Toledo, O., $25,000; electrical machinery and apparatus; Frederick Bissell, Frederick H. Dodge and John A. Erner.

Pennsylvania Lubricating Co., Pittsburg, Pa.; $50,000, with $5,000 paid in; lubricating and mineral oils; Treas., Grant McCargo, 34th St., Pittsburg.

Lindsley Manor Land & Improvement Co., Newark, N. J.; $50,000, with $5,000 paid in; water-works, etc.; William Scarlett and John B. Morrison.

Humboldt Mfg. Co., Arcata, Cal.; $15,000, with $5,100 paid in; saw mills, flour mills, electric light plant; C. A. Callstorm, William Chaffey and J. A. Rydon.

Hersey-Atwood Heater Co., Clifton, N. J.; $50,000, all paid in; Kimball C. Atwood and Geo. H. Hersey, Clifton, N. J.; and Chas. H. Spencer, Buffalo, N. Y.

Cumberland Construction Co., Bridgeton, N. J.; $50,000, with $2,500 paid in; railways, bridges, sewers, docks, etc.; William O. Garrison, Bloomfield H. Minch and Edwin Matlack.

American Motor Co., New York, N. Y.; $3,000,000, with $500 paid in; gas for power purposes; J. C. Henderson and L. M. Scott, of New York, N. Y.; J. C. Scott, of Philadelphia, Pa.

Indestructible Incandescent Gas Burner Co., Camden, N. J.; $500,000, with $5,000 paid in; Charles V. Fornes, New York, N. Y.; William K. Park, Philadelphia, Pa., and B. F. Archer, Camden, N. J.

Sea Beach Construction Co., Jersey City, N. J., and Portland, Me.; $100,000, with $1,000 paid in; electric railways; John E. Bowles, New York, N. Y., and J. Herbert Potts, Jersey City, N. J.

Universal Realty Corporation, Newark, N. J.; $50,000, with $15,000 paid in; land and street improvement; Luther G. Gadd, and Charles H. Litchman, of Newark, N. J.; Wm. Oppenheim, of Iselin, N. J.

Southern New England Paving Co., Jersey City, N. J., and Hartford, Conn.; $100,000, with $70,000 paid in; asphalt and other paving and other municipal work; Wm. P. Eno, of Saugatuck, Conn.; George H. Day, of Hartford, Conn.; W. S. Whitney, Orange, N. J.

Peter Barclay Mfg. Co., Jersey City, N. J., and Boston, Mass.; $50,000, with $1,000 paid in; to manufacture the Barclay patent automatic cylinder lubricator, valves, gages, etc.; Peter Barclay and John F. Warner, Boston, Mass.; David Selkerk, New York, N. Y.

AN ENGINEER INFORMED US SATURDAY that he was so busy he could not attend to all his regular correspondence, but that because he found our Construction News items of value to himself he would send us all the items he could, even at the sacrifice of other duties. If you find this department of value to yourself, we ask you also to send us what items you can in regard to projected work or bids opened, stating such facts in regard to the work as will make the item of value to others.

PROPOSALS FOR WATER-WORKS, SEWERS, and other municipal work should be inserted in Engineering News, which would bring the work to the attention of prominent contractors and manufacturers of contractors' supplies in all sections of the country, and thus ensure a competition which would doubtless result in large savings on contracts.

MORE THAN 150 REPLIES WERE RECEIVED, an engineer writes us, from a recent insertion of a water-works advertisement in Engineering News. It would have taken a large number of daily papers and cost a considerable sum of money to have secured this result by the old-fashioned method of advertising work only in daily papers.

IN THE 20 ISSUES OF ENGINEERING NEWS from Jan. 3 to May 16, there were printed 194 different proposal advertisements, about 400 total insertions, asking for bids for work in over 100 cities and towns. Among the municipal advertisements were the following: Sewers, pipe and pumping engines, at Brooklyn, N. Y.; sewers and bridges, at Providence, R. I.; sewers, paving, etc., at Washington, D. C.; paving (5 advertisements) and water conduit, at Erie, Pa.; paving and sewers, at Peoria, Ill.; laying water pipe (4 advertisements, 13 insertions), at New Orleans, La.; large grading contract, at St. Louis, Mo.; bridge work, at Providence, Cincinnati, Denver, Atlanta, Nashville and other cities; courthouse, at Baltimore, Md.; electric light plants in several cities; water-works construction in all parts of the country, including Astoria, Ore., and Santa Clara, Cal.; and also several railway contracts.

MORE THAN 900 DIFFERENT CITIES have advertised work in this paper within a few years. This includes, in addition to large cities and important contracts, as noted above, hundreds of smaller contracts in towns and villages representing nearly every section of the United States and Canada. Villages and small cities find this paper the best, as well as the most inexpensive, medium for bringing their work to the attention of desirable parties, and larger cities secure increased competition by advertising work in this paper. Many cities are now advertising all their work in Engineering News, and every city that does this saves money by so doing.

ENGINEERING NEWS PRINTS MORE reliable news items, a larger number of proposal advertisements, and is much more extensively read by contractors and manufacturers of contractors' supplies than any other paper in America. These facts should be borne in mind. They may save you or your city large sums of money on contracts.